The Tor Project, Inc.

Our mission is to be the global resource for technology, advocacy, research and education in the ongoing pursuit of freedom of speech, privacy rights online, and censorship circumvention.

What is Tor?

Online anonymity 1) open source software, 2) network, 3) protocol

Community of researchers, developers, users, and relay operators

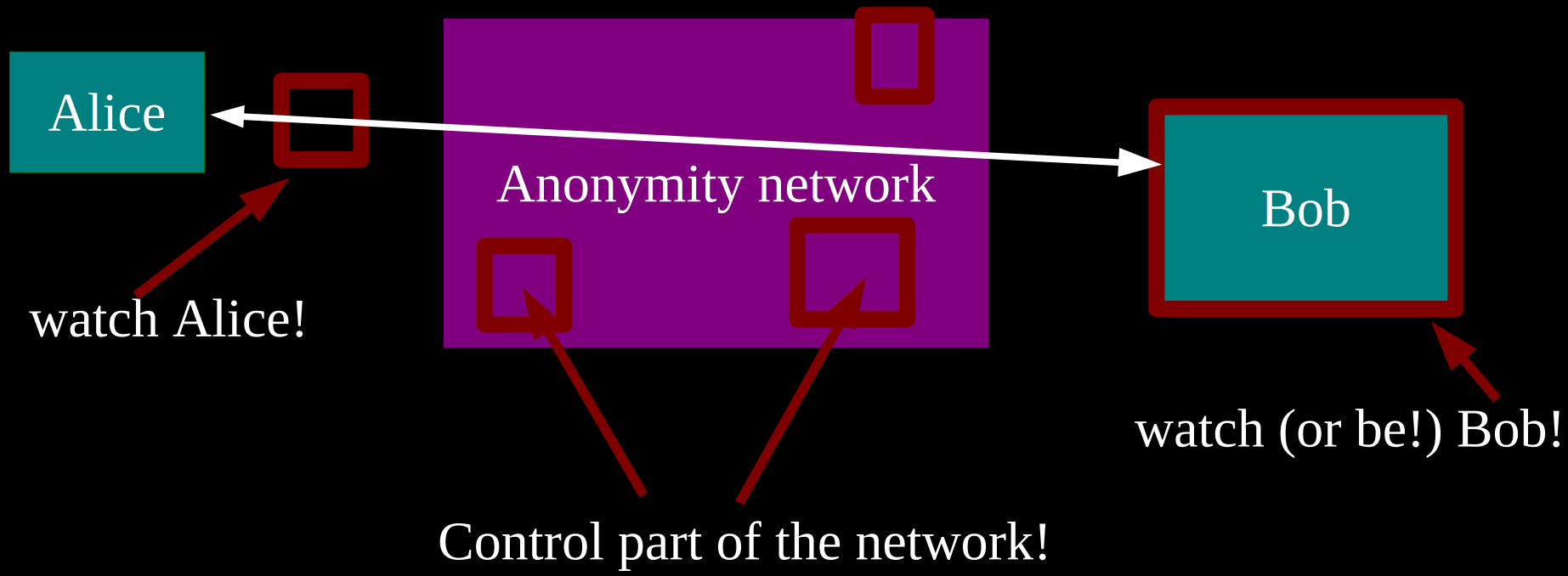
Funding from US DoD, Electronic Frontier Foundation, Voice of America, Google, NLnet, Human Rights Watch, NSF, US State Dept, SIDA, Knight Foundation, ...

The Tor Project, Inc.

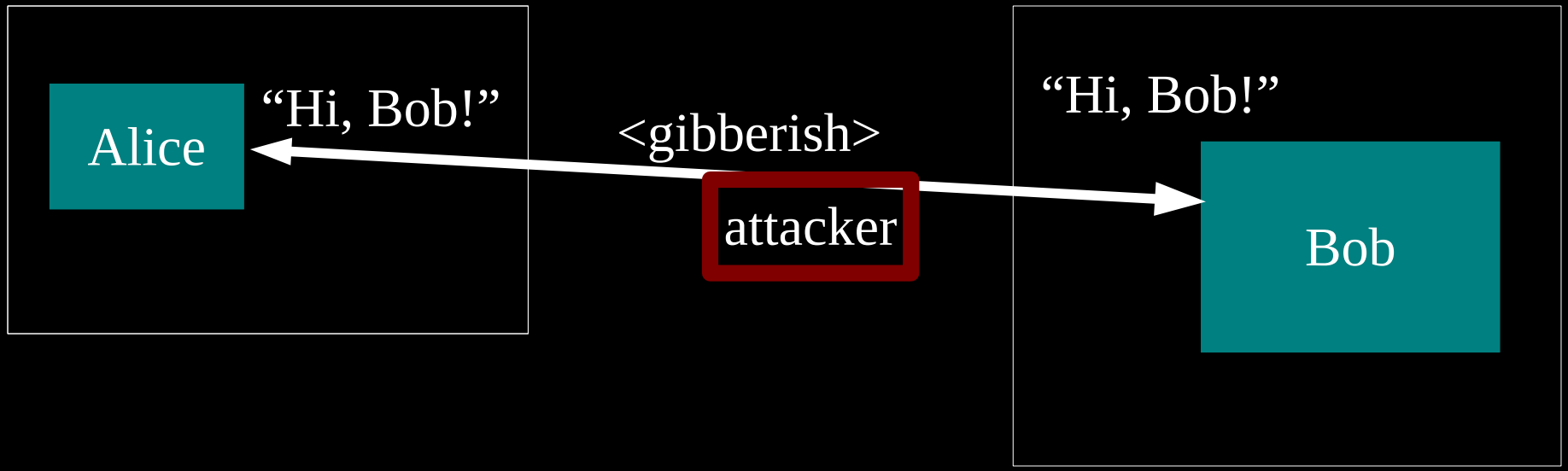
U.S. 501(c)(3) non-profit organization dedicated to the research and development of tools for online anonymity and privacy

Estimated ~800,000?
daily Tor users

Threat model: what can the attacker do?



Anonymity isn't encryption: Encryption just protects contents.



Anonymity isn't just wishful thinking...

“You can't prove it was me!”

“Promise you won't look!”

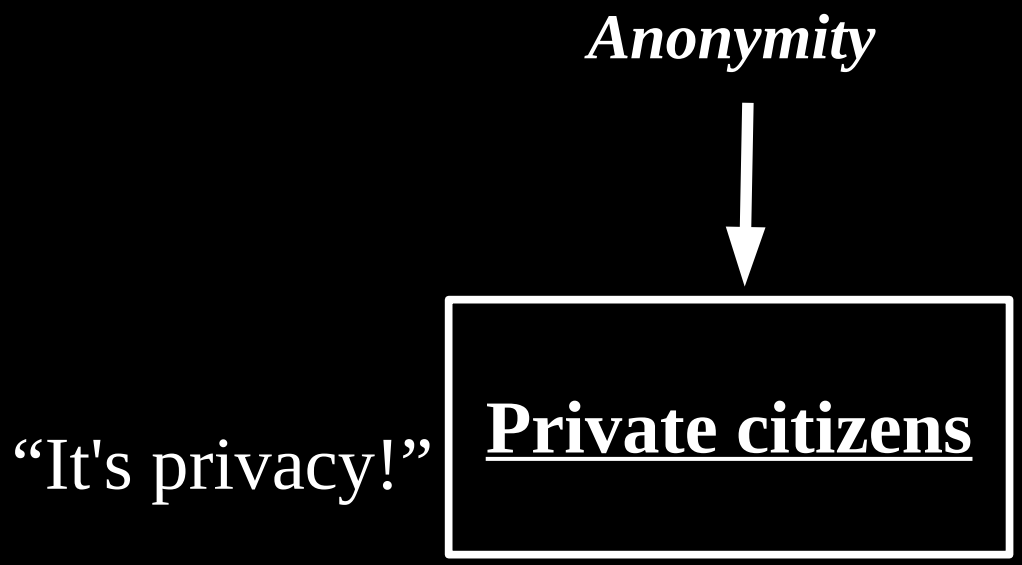
“Promise you won't remember!”

“Promise you won't tell!”

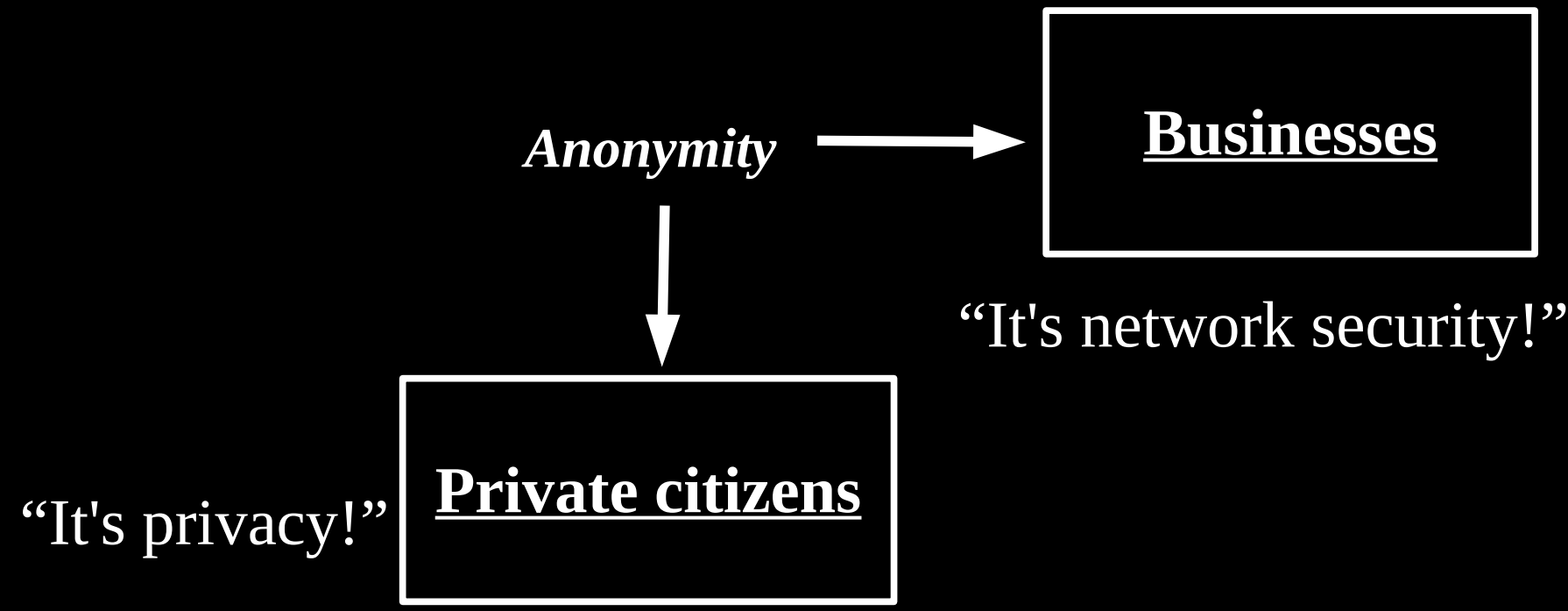
“I didn't write my name on it!”

“Isn't the Internet already anonymous?”

Anonymity serves different interests for different user groups.



Anonymity serves different interests for different user groups.



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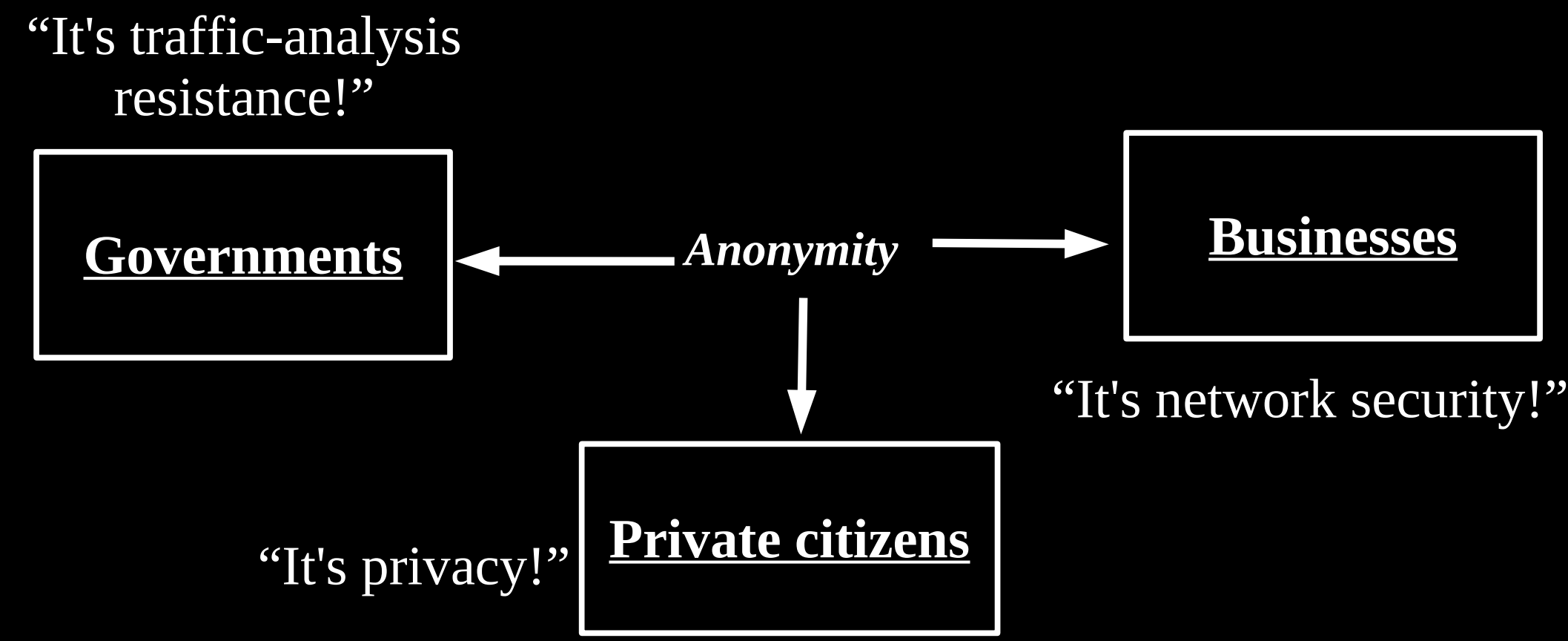

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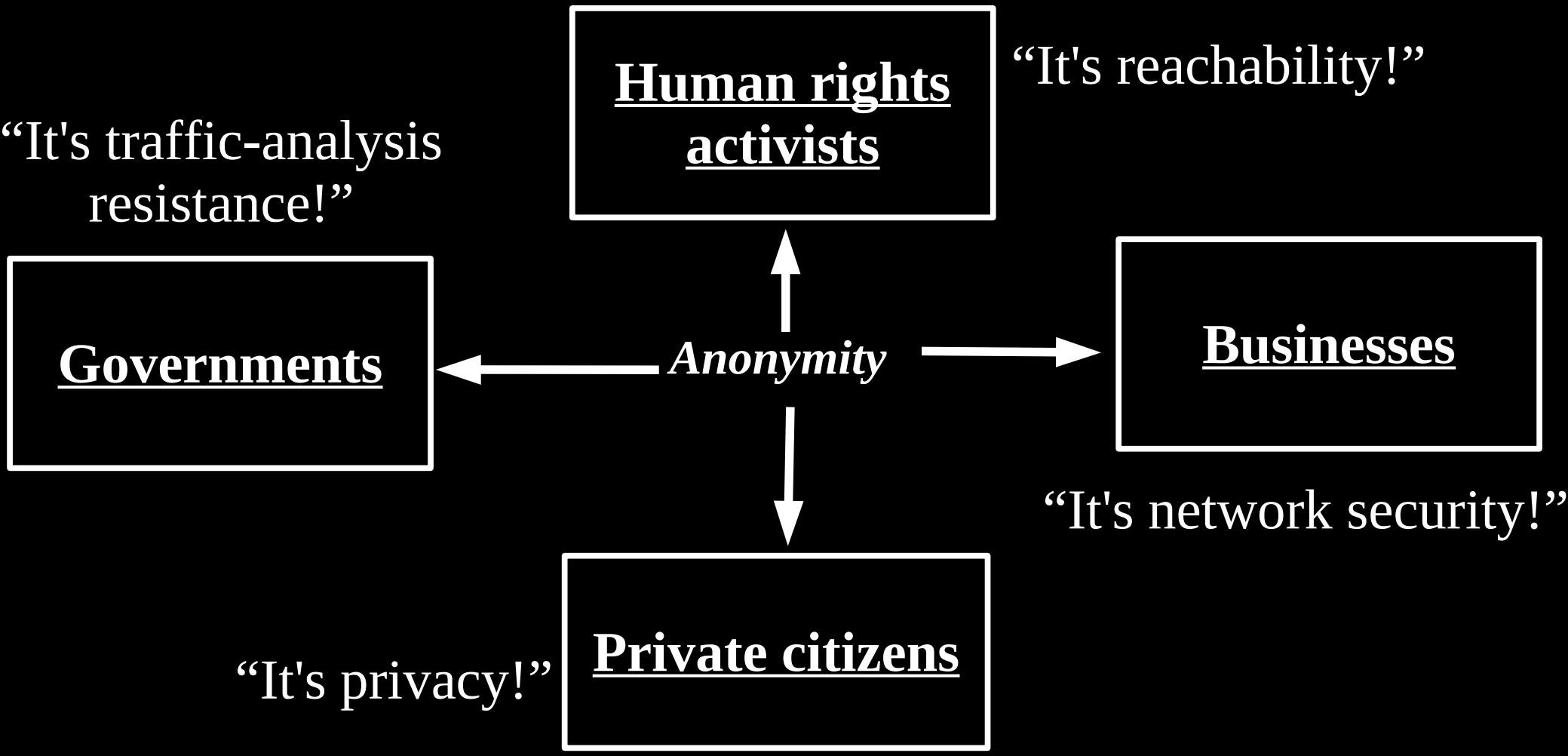
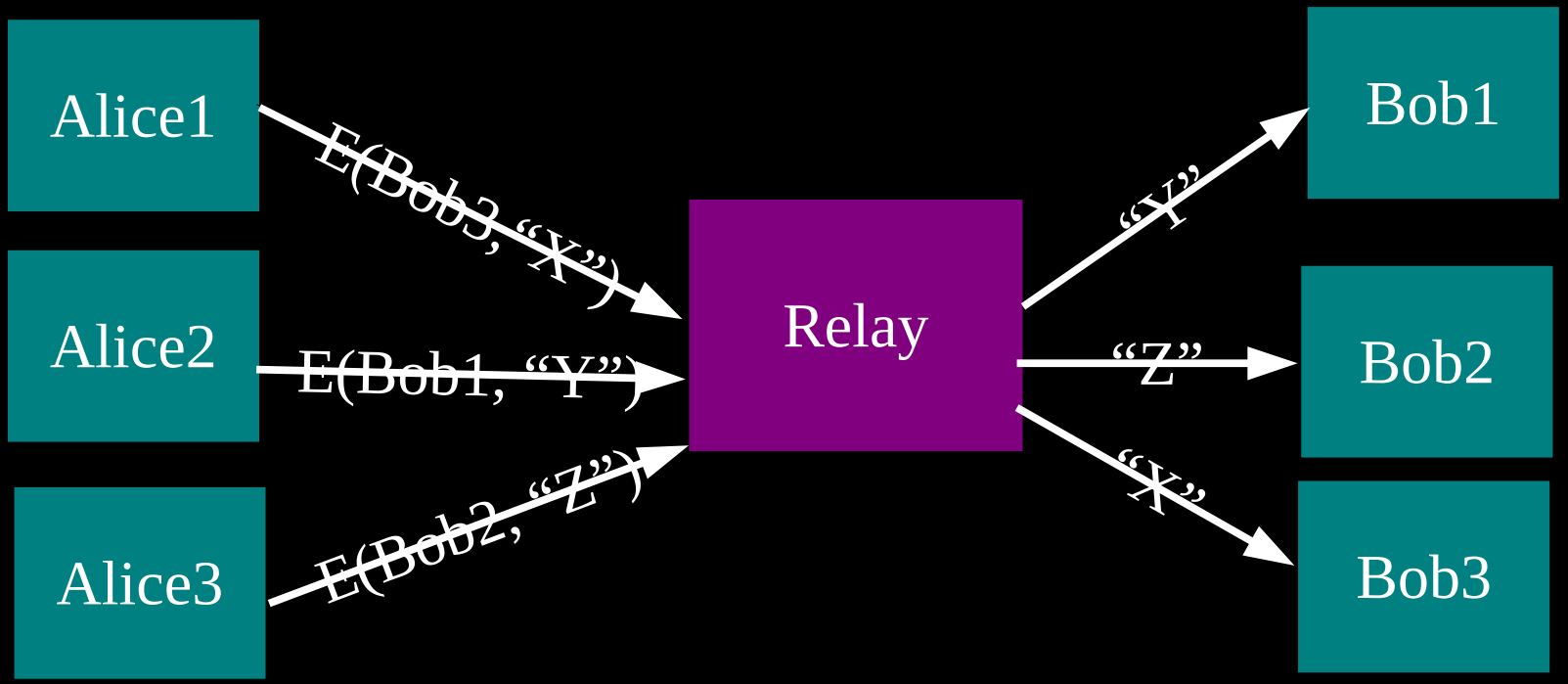
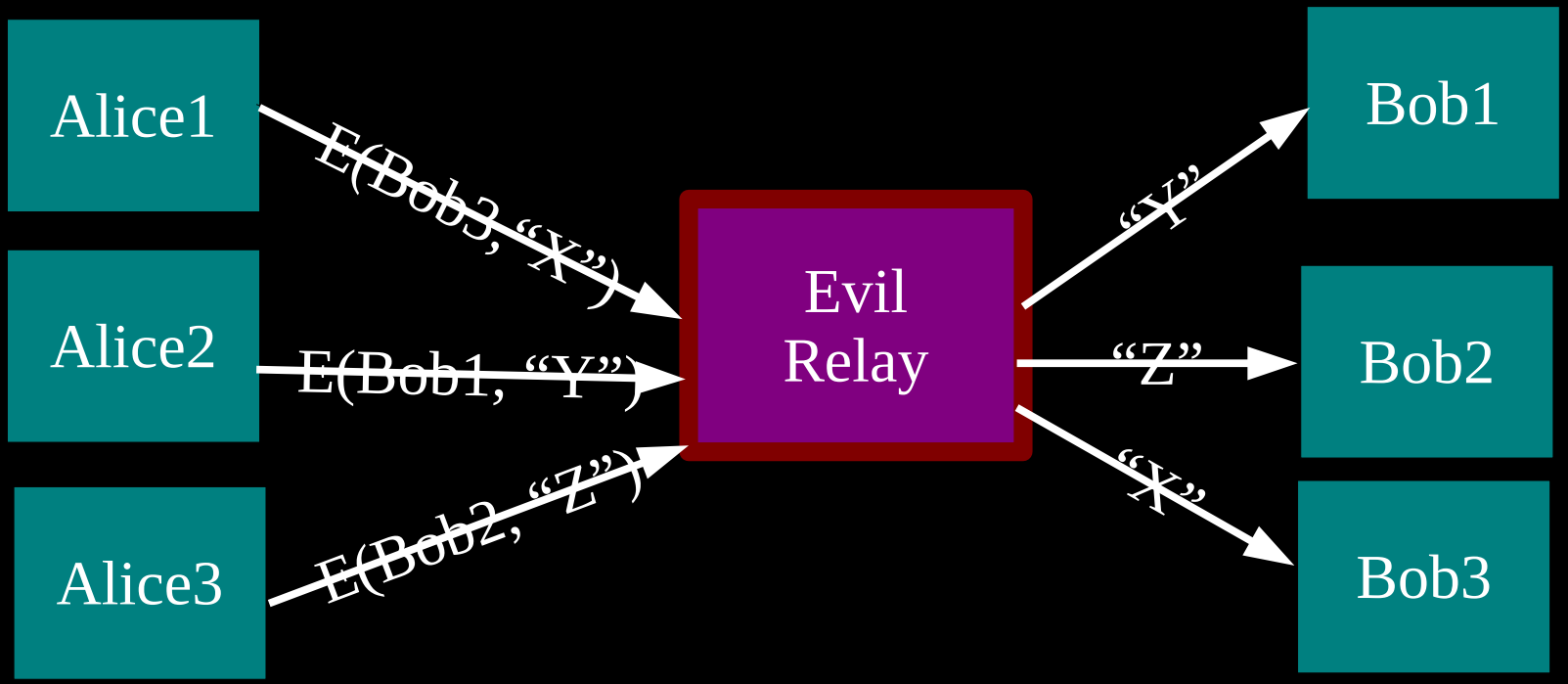


The simplest designs use a single relay to hide connections.

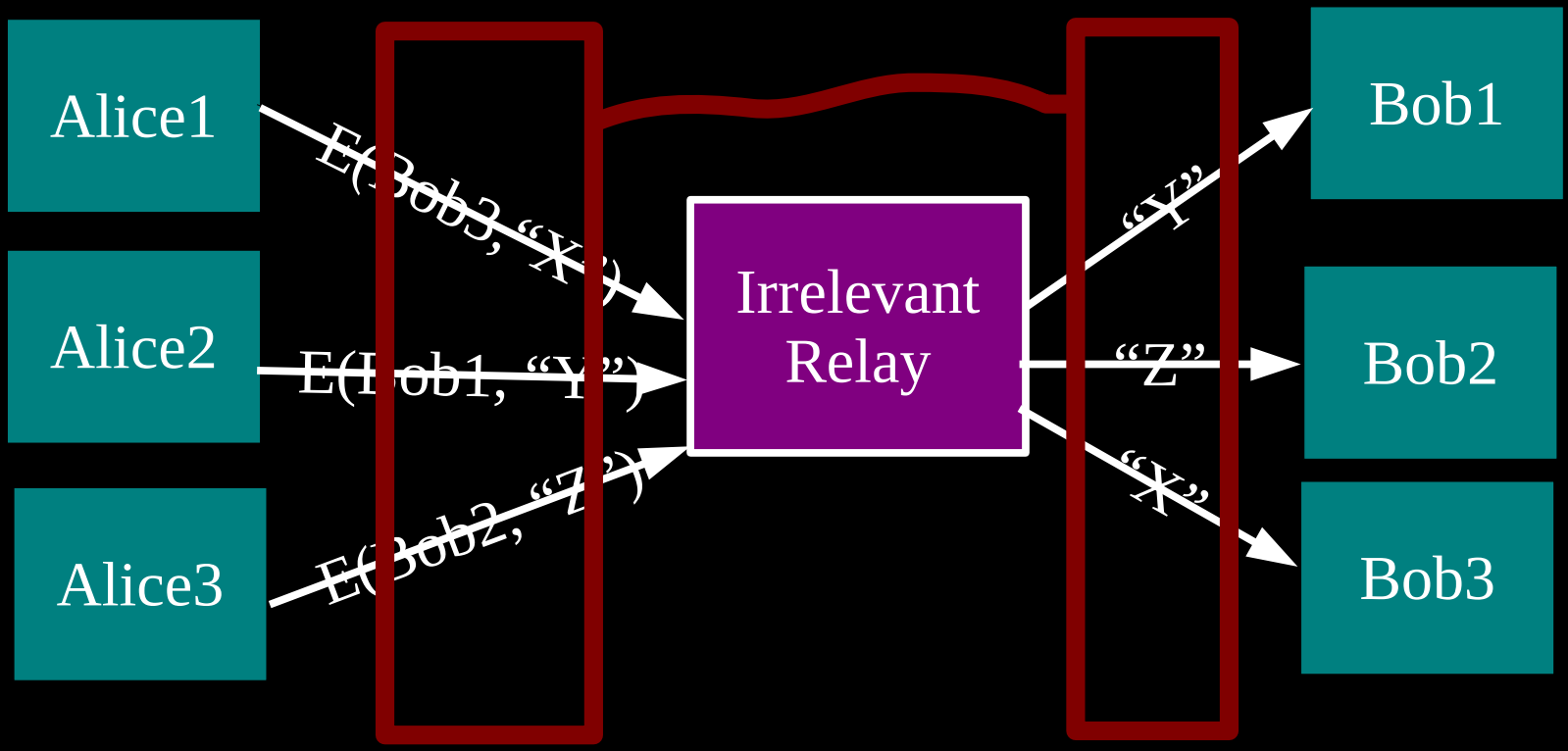


(example: some commercial proxy providers)

But a single relay (or eavesdropper!) is a single point of failure.

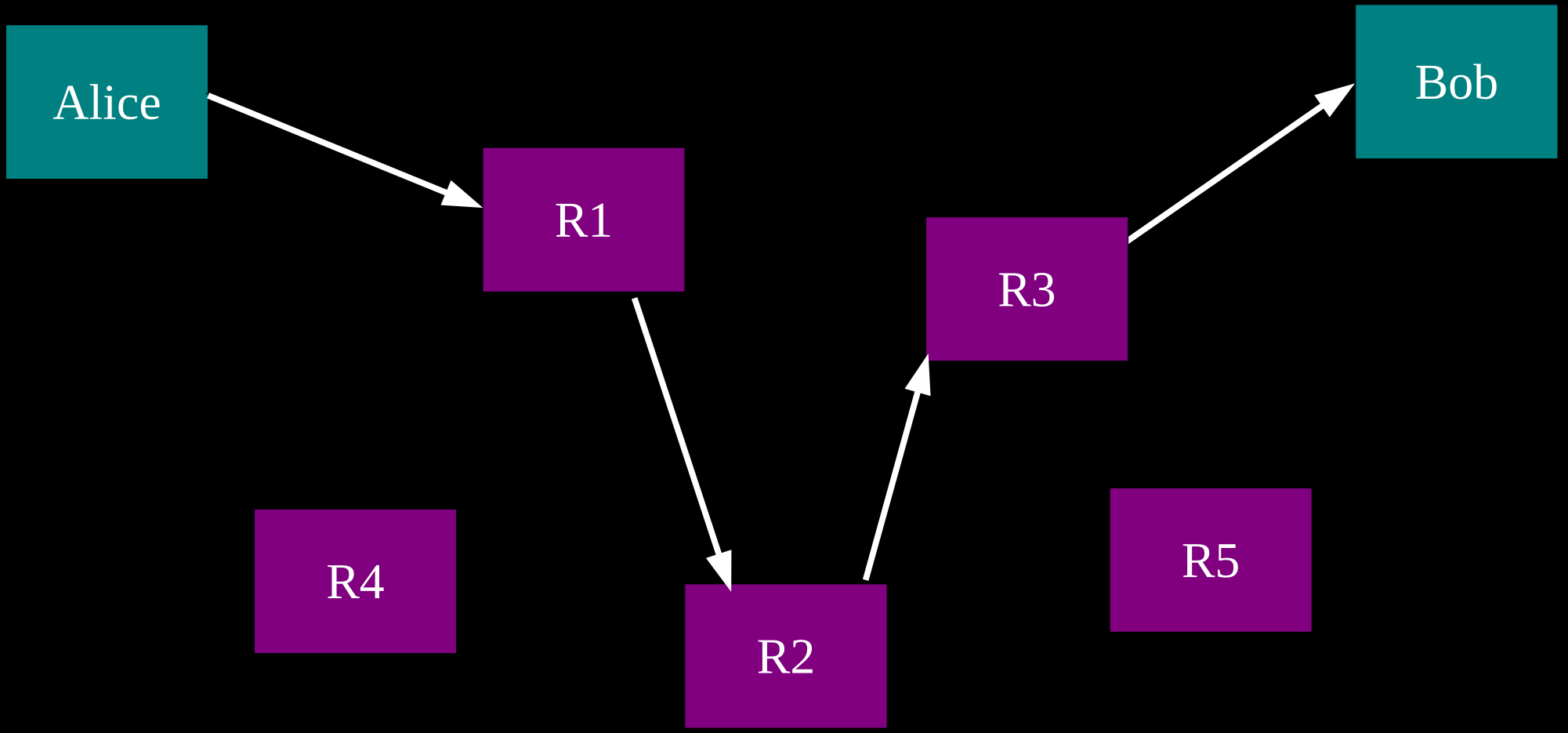


... or a single point of bypass.

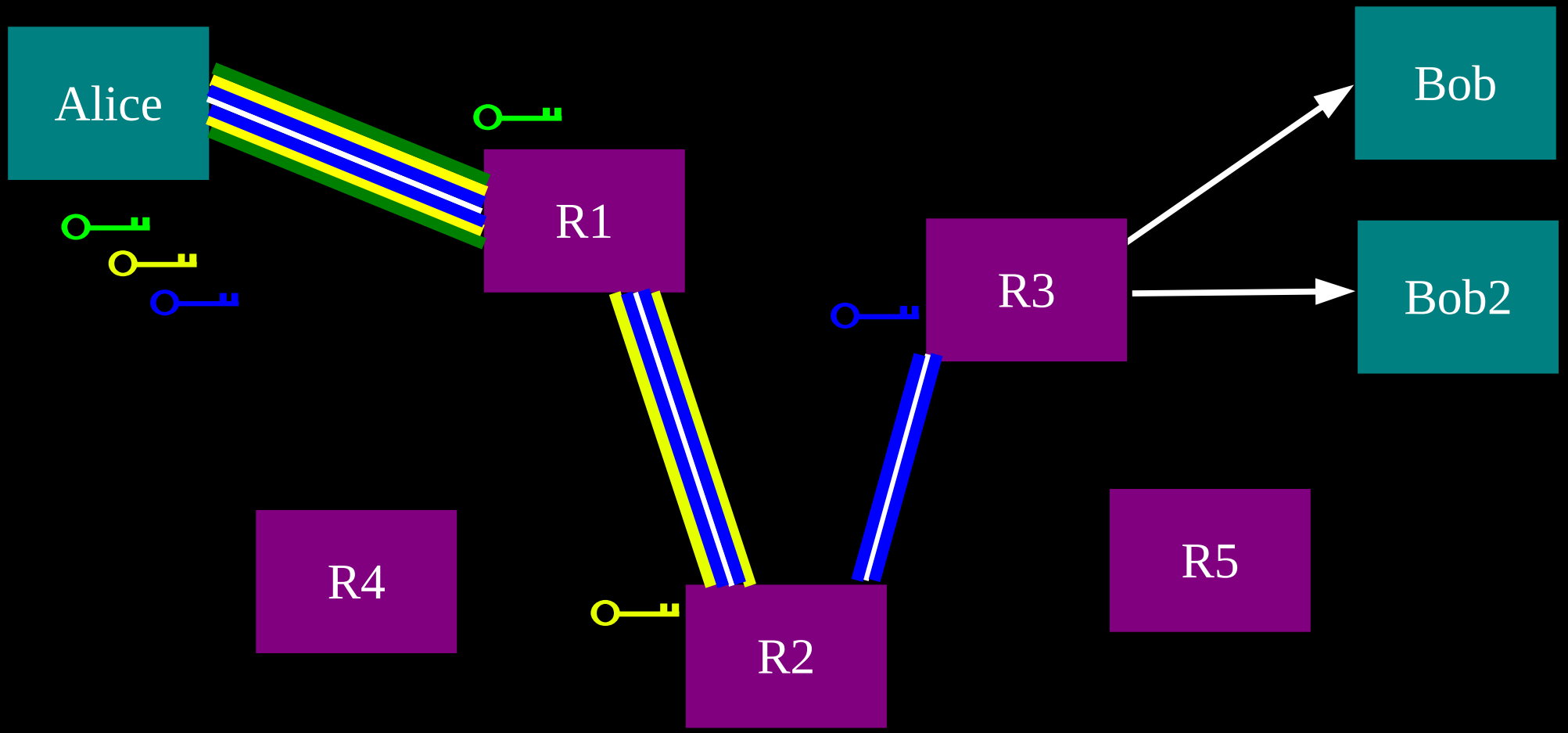


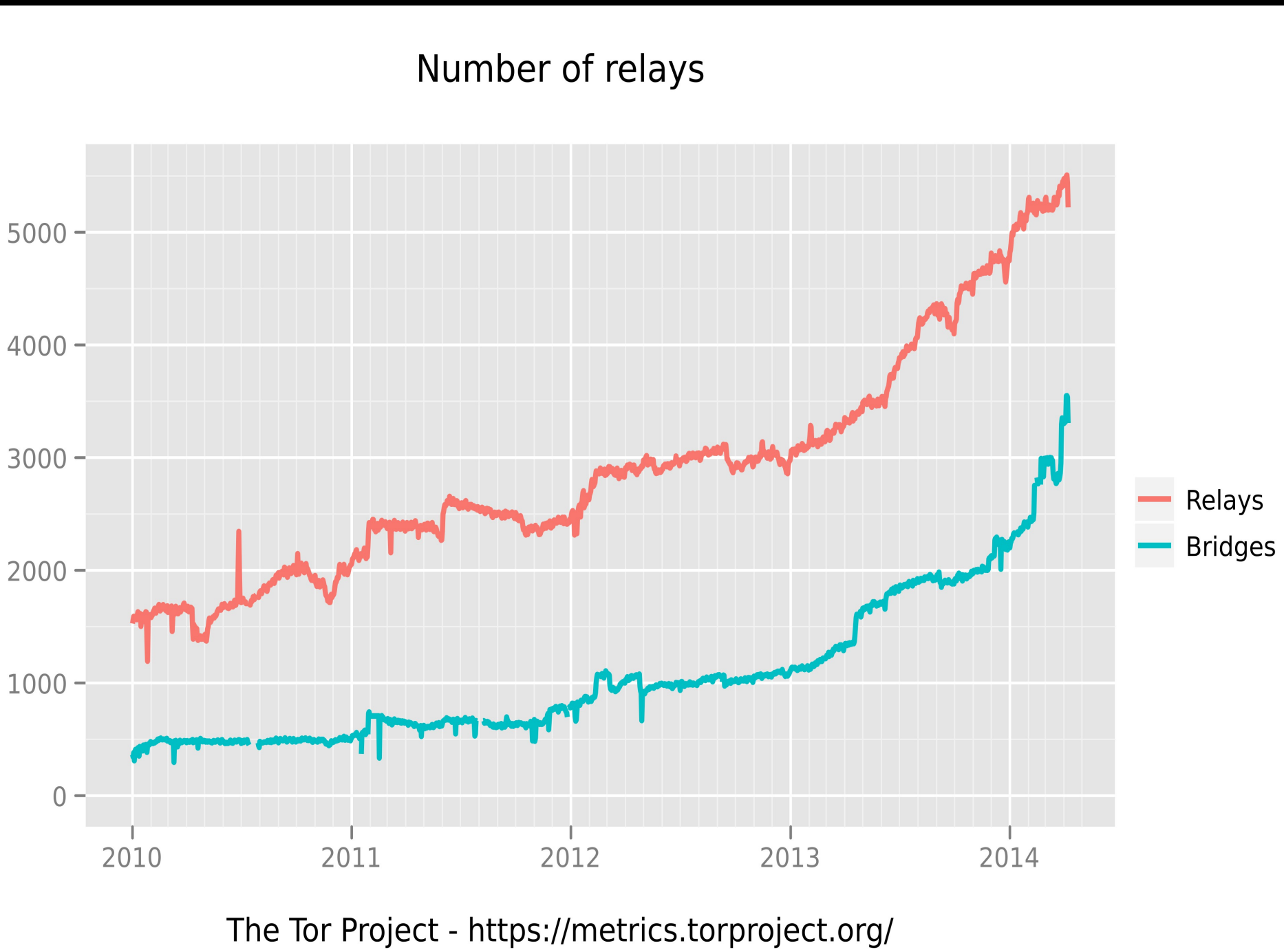
Timing analysis bridges all connections through relay ⇒ An attractive fat target

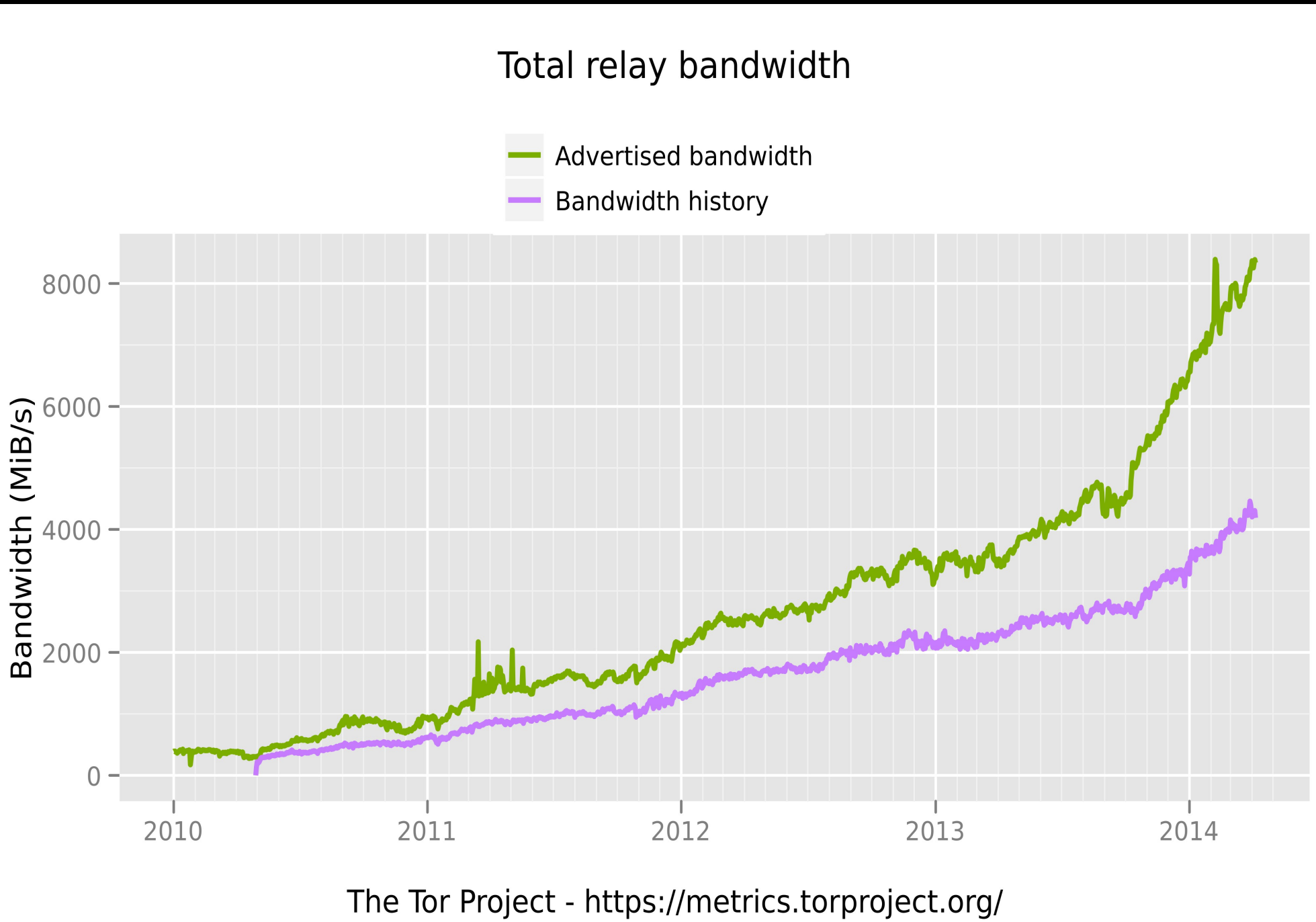
So, add multiple relays so that no single one can betray Alice.



Alice makes a session key with R1 ...And then tunnels to R2...and to R3




Number of relays
5000
4000
3000
2000
1000
0
2010
2011
2012
2013
2014
Relays
Bridges
The Tor Project - https://metrics.torproject.org/


Total relay bandwidth
Advertised bandwidth
Bandwidth history
Bandwidth (MiB/s)
8000
6000
4000
2000
0
2010
2011
2012
2013
2014
The Tor Project - https://metrics.torproject.org/

Tor Research Home

Many people around the world are doing research on how to improve the Tor design, what's going on in the Tor netwo
generally on attacks and defenses for anonymous communication systems. This page summarizes the resources we
make your Tor research more effective. The best way to reach us about research is through the tor-assistants list.

- **Data.** We've been collecting data to learn more about the Tor network: how many relays and clients there are i
what capabilities they have, how fast the network is, how many clients are connecting via bridges, what traffic
etc. We are also developing tools to process these huge data archives and come up with useful statistics. Let
other information you'd like to see, and we can work with you to help make sure it gets collected safely and rol
- **Analysis.** If you're investigating Tor, or solving a Tor-related problem, _*please*_ talk to us somewhere along th
earlier the better. These days we review too many conference paper submissions that make bad assumptions
solving the wrong problem. Since the Tor protocol and the Tor network are both moving targets, measuring thi
understanding what's going on behind the scenes is going to result in bad conclusions. In particular, different
unwittingly run a variety of experiments in parallel, and at the same time we're constantly modifying the desig
approaches. If you let us know what you're doing and what you're trying to learn, we can help you understand
variables to expect and how to interpret your results.
- **Measurement and attack tools.** We're building a repository of tools that can be used to measure, analyze, or
on Tor. Many research groups end up needing to do similar measurements (for example, change the Tor desig
and then see if latency improves), and we hope to help everybody standardize on a few tools and then make t
Also, while there are some really neat Tor attacks that people have published about, it's hard to track down a c
they used. Let us know if you have new tools we should list, or improvements to the existing ones. The more th
stage.
- **We need defenses too — not just attacks.** Most researchers find it easy and fun to come up with novel attac
systems. We've seen this result lately in terms of improved congestion attacks, attacks based on remotely mea
throughput, and so on. Knowing how things can go wrong is important, and we recognize that the incentives in
aligned with spending energy on designing defenses, but it sure would be great to get more attention to how t
attacks. We'd love to help brainstorm about how to make Tor better. As a bonus, your paper might even end up
"countermeasures" section.
- **In-person help.** If you're doing interesting and important Tor research and need help understanding how the T

Tor Controller Interface

- **stem**
- pytorctl
- jtorctl
- **txtorcon**

```
meejah@pretend:~/src/txtorcon-github$ make
trial --reporter=text txtorcon.test
.....................................................................
.....................................................................
.............................
.............................
---------------------------------------------------------------------
Ran 229 tests in 1.140s

PASSED (successes=229)
meejah@pretend:~/src/txtorcon-github$ python examples/launch_tor_endpoint.py
10%: Finishing handshake with directory server
15%: Establishing an encrypted directory connection
20%: Asking for networkstatus consensus
25%: Loading networkstatus consensus
40%: Loading authority key certs
45%: Asking for relay descriptors
80%: Connecting to the Tor network
85%: Finishing handshake with first hop
90%: Establishing a Tor circuit
100%: Done
I have set up a hidden service, advertised at:
http://567zt26xqpvmdwcs.onion:80
locally listening on IPv4Address(TCP, '0.0.0.0', 31855)
```

Tor specs

- The **specifications** aim to give developers enough information to build a compatible version of Tor:
  - Main Tor specification
  - Tor version 3 directory server specification (and older version 2 directory specification)
  - Tor control protocol specification
  - Tor rendezvous specification
  - Tor path selection specification
  - Special hostnames in Tor
  - Tor's SOCKS support and extensions
  - How Tor version numbers work
  - In-progress drafts of new specifications and proposed changes

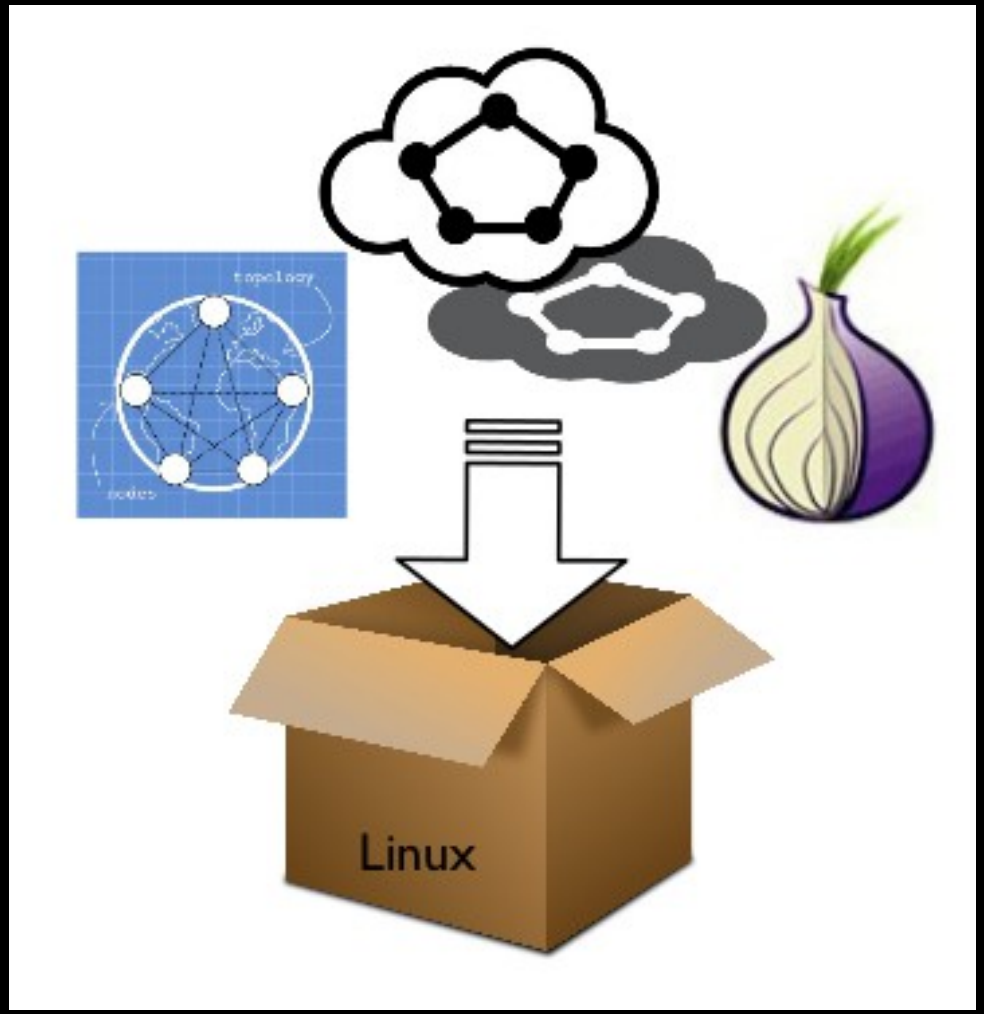
freehaven.net/anonbib/

2012

- **Congestion-aware Path Selection for Tor** (PDF) (Cached: PDF)
  by Tao Wang, Kevin Bauer, Clara Forero, and Ian Goldberg.
  In the Proceedings of Financial Cryptography and Data Security (FC'12), February 2012. (BibTeX entry)
- **BLACR: TTP-Free Blacklistable Anonymous Credentials with Reputation** (PDF) (Cached: PDF)
  by Man Ho Au, Apu Kapadia, and Willy Susilo.
  In the Proceedings of the 19th Annual Network and Distributed System Security Symposium (NDSS), February 2012. (BibTeX entry)
- **Shadow: Running Tor in a Box for Accurate and Efficient Experimentation** (PDF) (Cached: PDF)
  by Rob Jansen and Nicholas Hopper.
  In the Proceedings of the Network and Distributed System Security Symposium - NDSS'12, February 2012. (BibTeX entry)
- **Peek-a-Boo, I Still See You: Why Efficient Traffic Analysis Countermeasures Fail** (PDF) (Cached: PDF)
  by Kevin P. Dyer, Scott E. Coull, Thomas Ristenpart, and Thomas Shrimpton.
  In the Proceedings of the 2012 IEEE Symposium on Security and Privacy, May 2012. (BibTeX entry)
- **LASTor: A Low-Latency AS-Aware Tor Client** (PDF) (Cached: PDF)
  by Masoud Akhoondi, Curtis Yu, and Harsha V. Madhyastha.
  In the Proceedings of the 2012 IEEE Symposium on Security and Privacy, May 2012. (BibTeX entry)
- **LAP: Lightweight Anonymity and Privacy** (PDF) (Cached: PDF)
  by Hsu-Chun Hsiao, Tiffany Hyun-Jin Kim, Adrian Perrig, Akira Yamada, Sam Nelson, Marco Gruteser, and Wei Ming.
  In the Proceedings of the 2012 IEEE Symposium on Security and Privacy, May 2012. (BibTeX entry)
- **How (not) to build a transport layer for anonymity overlays** (PDF) (Cached: PDF)

Tor network simulators

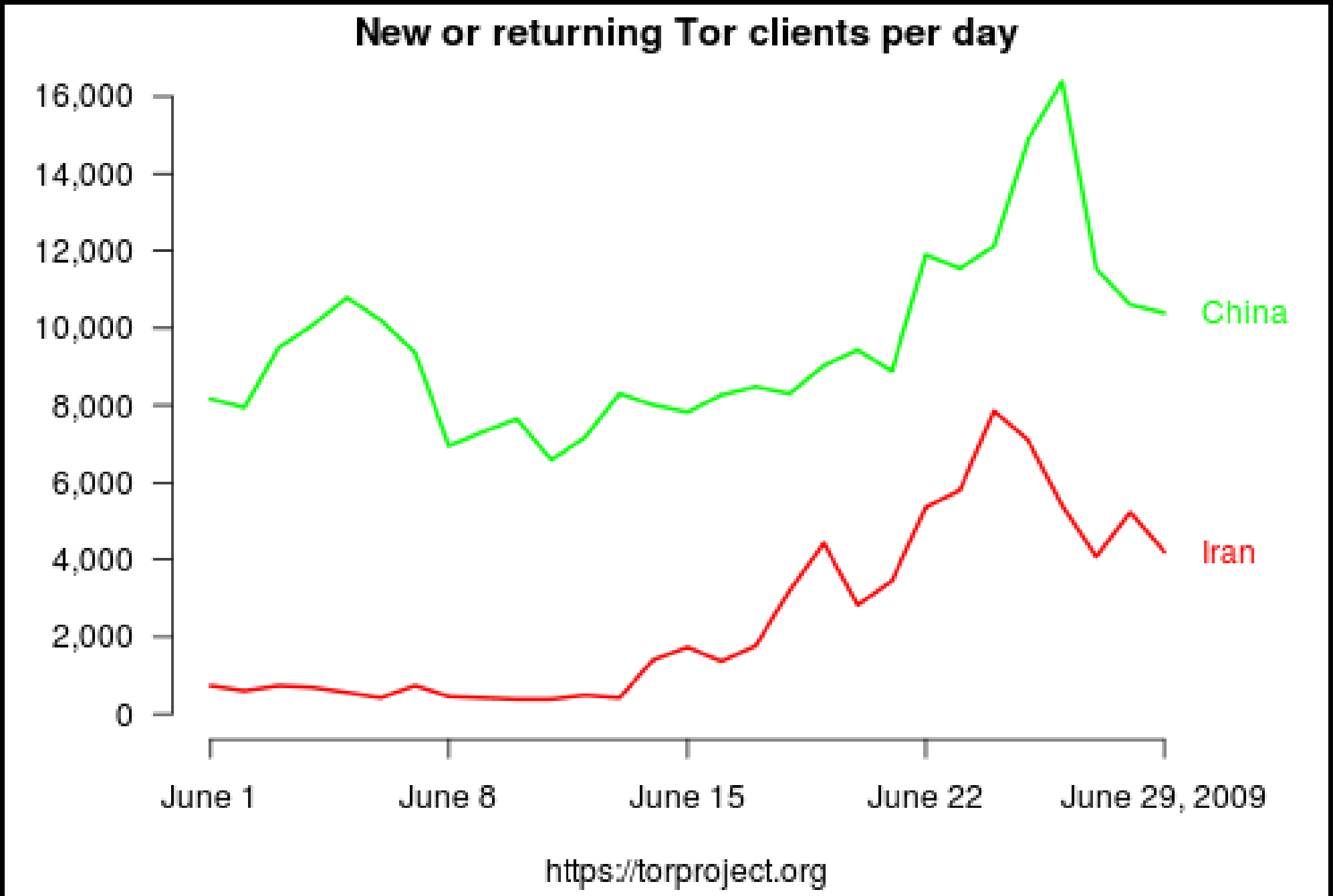
- **Shadow**
- ExperimenTor
- **Chutney**
- Puppetor

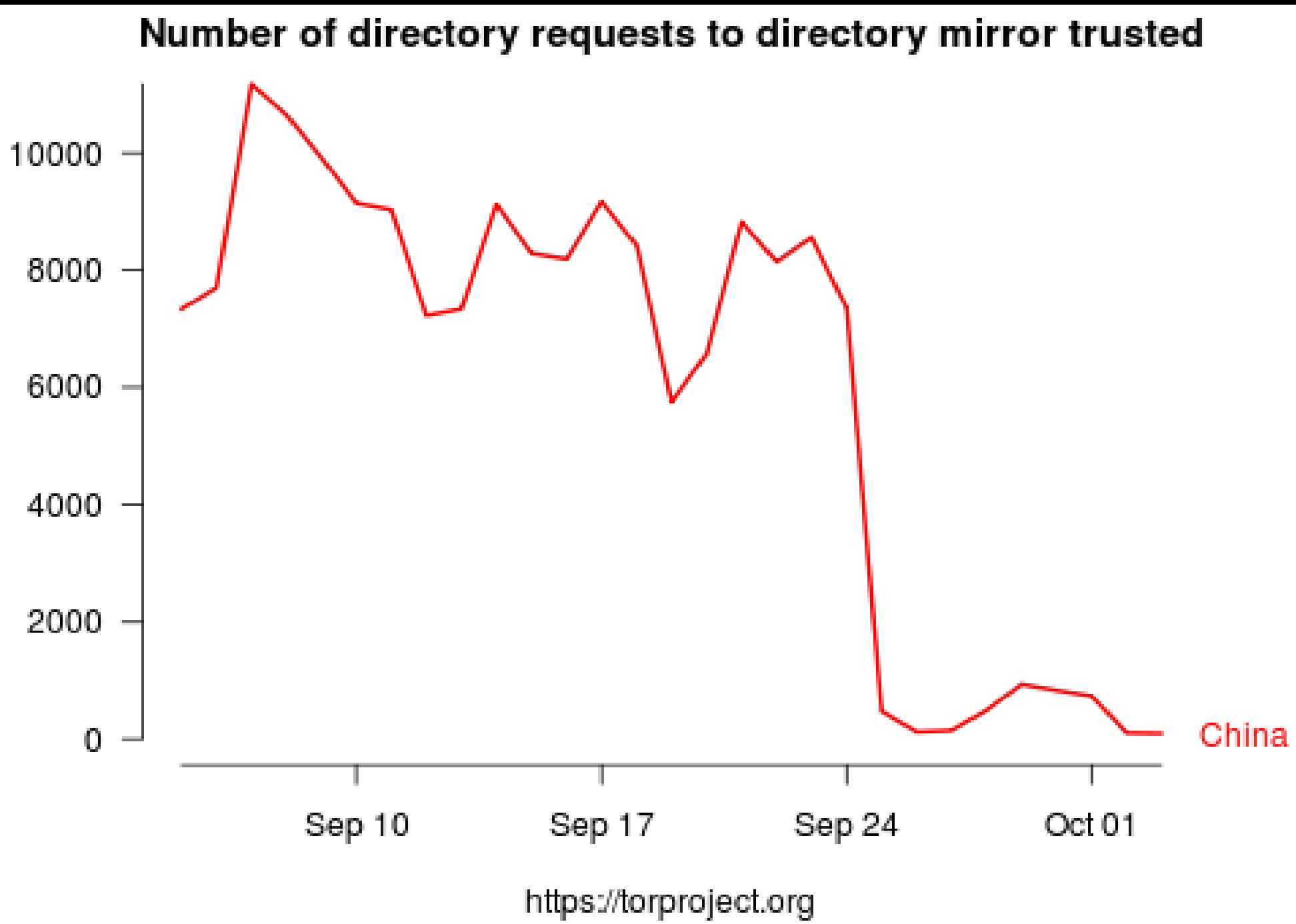


Relay descriptor archives

The relay descriptor archives contain all documents that the directory authorities make available about the network of relays. T
include network statuses, server (relay) descriptors, and extra-info descriptors. The data formats are described here.

May 2013		server descriptors	extra-infos	v3 votes	v
April 2013		server descriptors	extra-infos	v3 votes	v
March 2013		server descriptors	extra-infos	v3 votes	v
February 2013		server descriptors	extra-infos	v3 votes	v
January 2013		server descriptors	extra-infos	v3 votes	v
December 2012		server descriptors	extra-infos	v3 votes	v
November 2012		server descriptors	extra-infos	v3 votes	v
October 2012		server descriptors	extra-infos	v3 votes	v
September 2012		server descriptors	extra-infos	v3 votes	v
August 2012		server descriptors	extra-infos	v3 votes	v
July 2012		server descriptors	extra-infos	v3 votes	v
June 2012		server descriptors	extra-infos	v3 votes	v
May 2012		server descriptors	extra-infos	v3 votes	v
April 2012		server descriptors	extra-infos	v3 votes	v
March 2012	v2 statuses	server descriptors	extra-infos	v3 votes	v
February 2012	v2 statuses	server descriptors	extra-infos	v3 votes	v
January 2012	v2 statuses	server descriptors	extra-infos	v3 votes	v
December 2011	v2 statuses	server descriptors	extra-infos	v3 votes	v
November 2011	v2 statuses	server descriptors	extra-infos	v3 votes	v
October 2011	v2 statuses	server descriptors	extra-infos	v3 votes	v
September 2011	v2 statuses	server descriptors	extra-infos	v3 votes	v


New or returning Tor clients per day
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
China
Iran
June 1
June 8
June 15
June 22
June 29, 2009
https://torproject.org


Number of directory requests to directory mirror trusted
10000
8000
6000
4000
2000
0
Sep 10
Sep 17
Sep 24
Oct 01
China
https://torproject.org

Attackers can block users from connecting to the Tor network

1) By blocking the directory authorities

2) By blocking all the relay IP addresses in the directory, or the addresses of other Tor services

3) By filtering based on Tor's network fingerprint

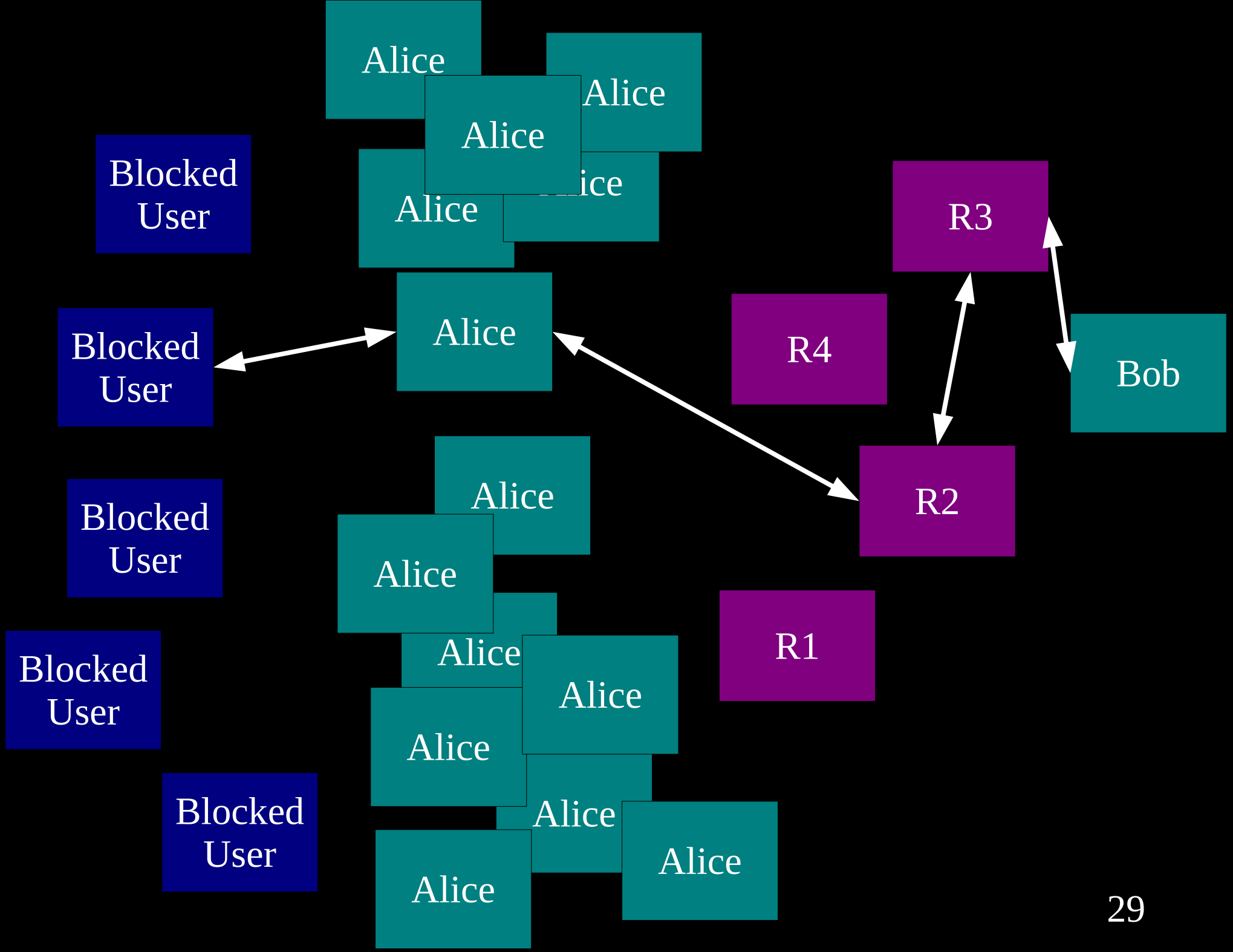
4) By preventing users from finding the Tor software (usually by blocking website)

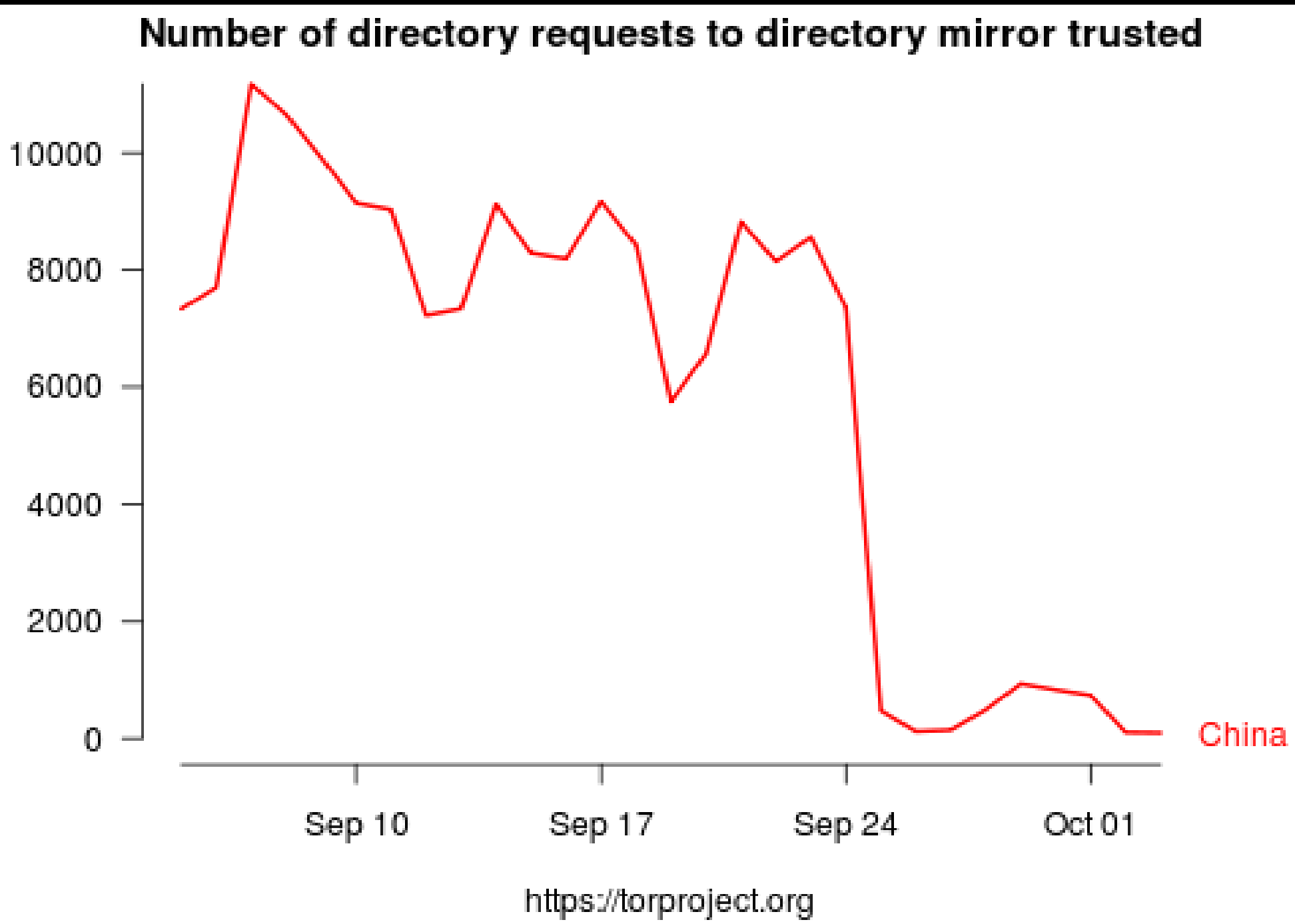
Relay versus Discovery

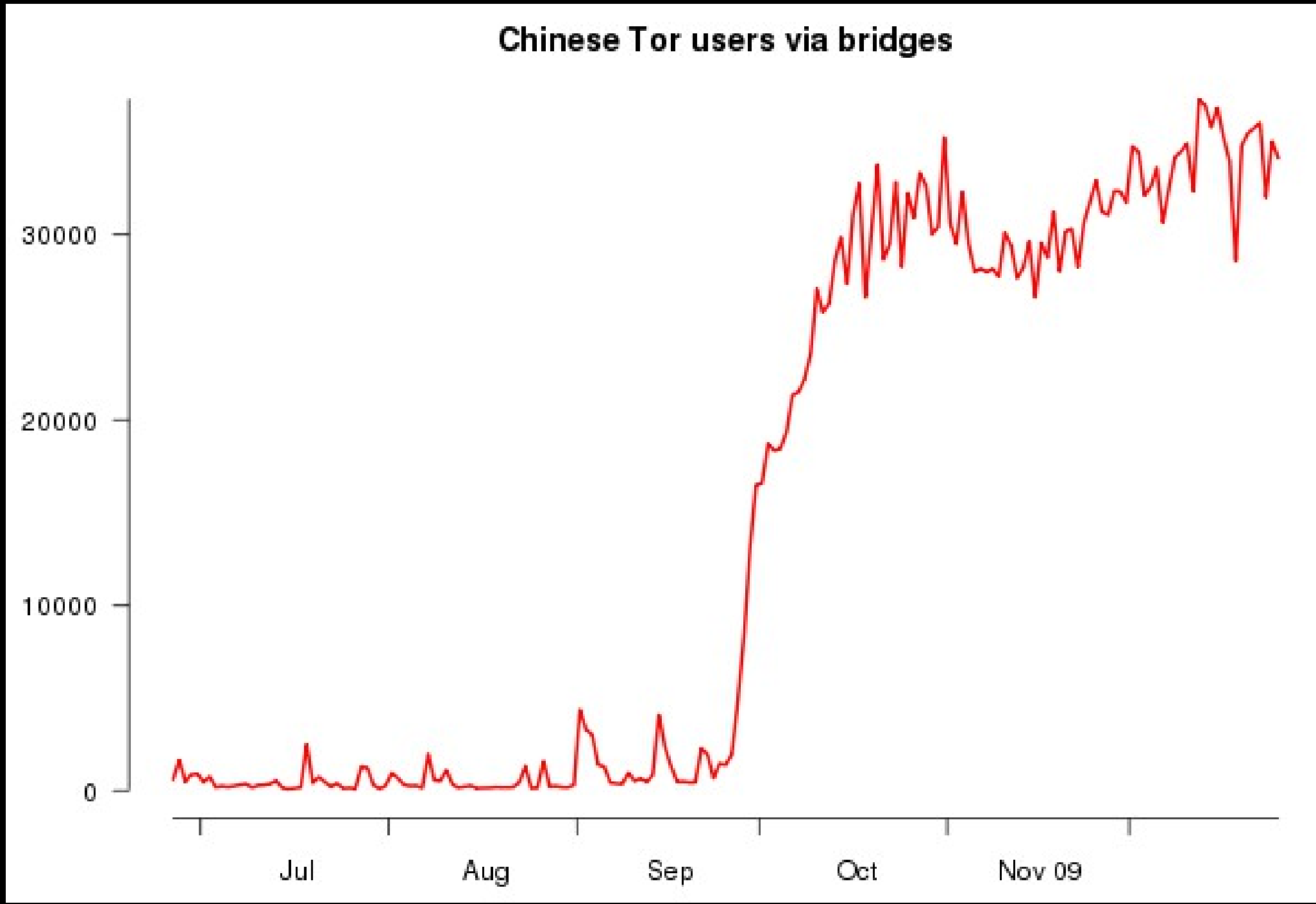
There are two pieces to all these “proxying” schemes:

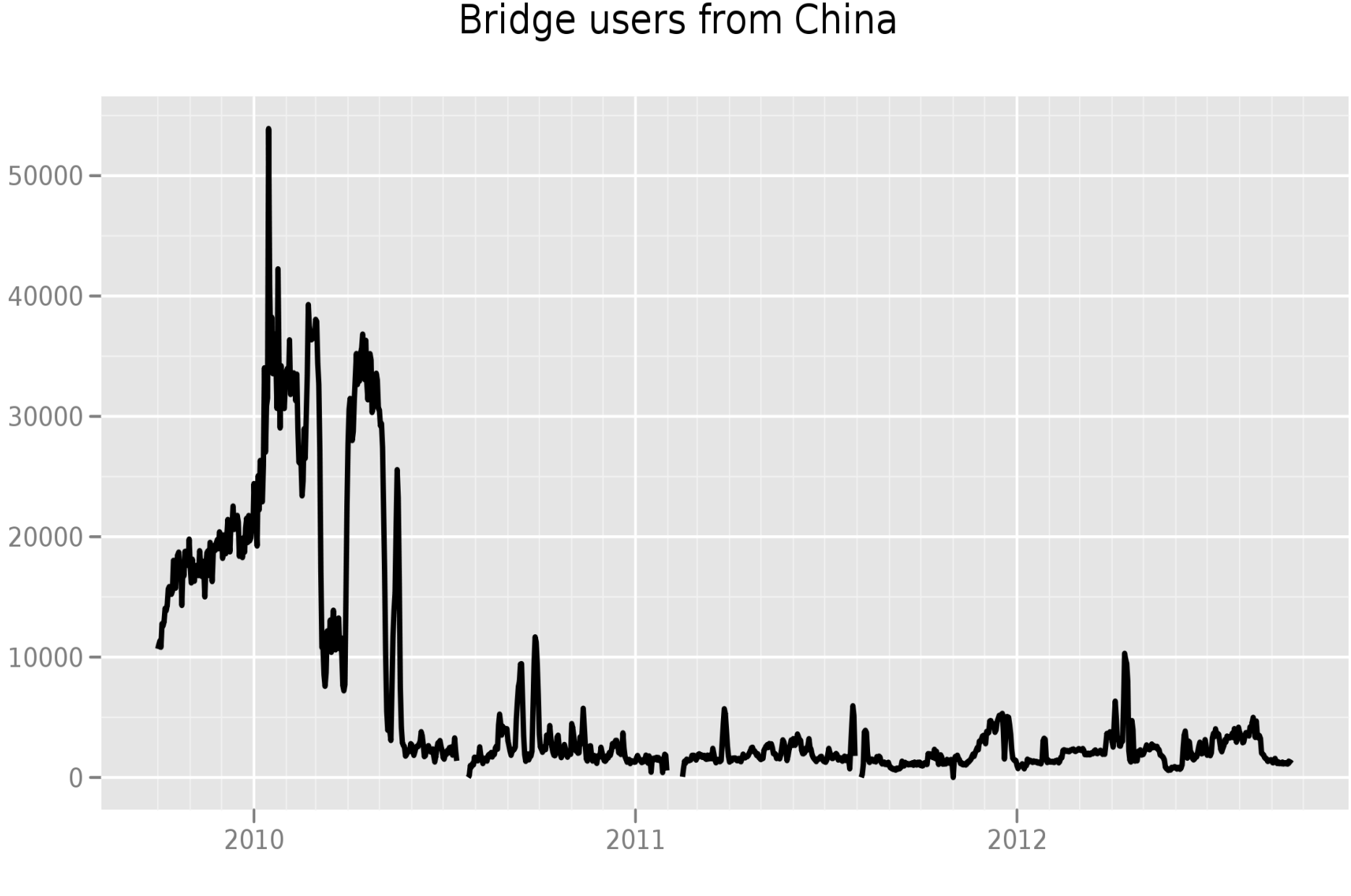
a **relay** component: building circuits, sending traffic over them, getting the crypto right

a **discovery** component: learning what relays are available


Alice
Alice
Alice
Alice
Alice
Blocked User
Blocked User
Blocked User
Blocked User
Blocked User
Alice
Alice
Alice
Alice
Alice
Alice
Alice
R3
R4
R2
R1
Bob

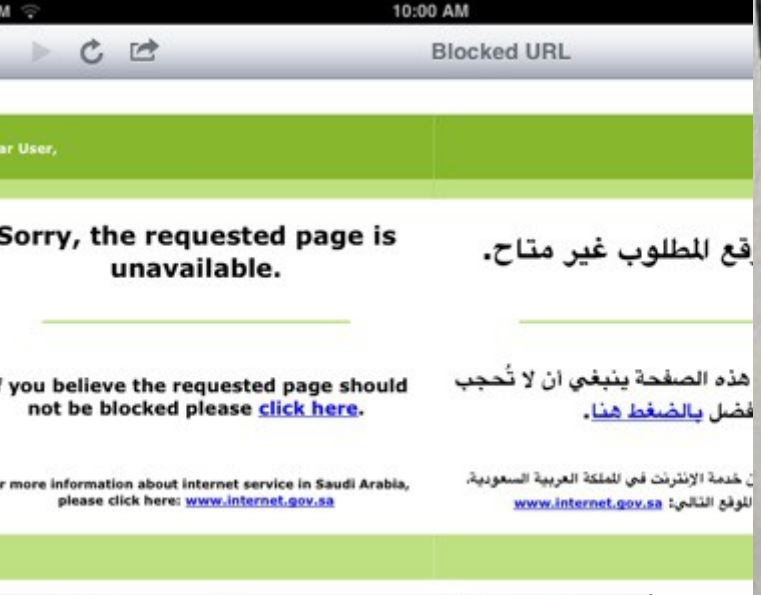

Number of directory requests to directory mirror trusted
10000
8000
6000
4000
2000
0
Sep 10
Sep 17
Sep 24
Oct 01
China
https://torproject.org

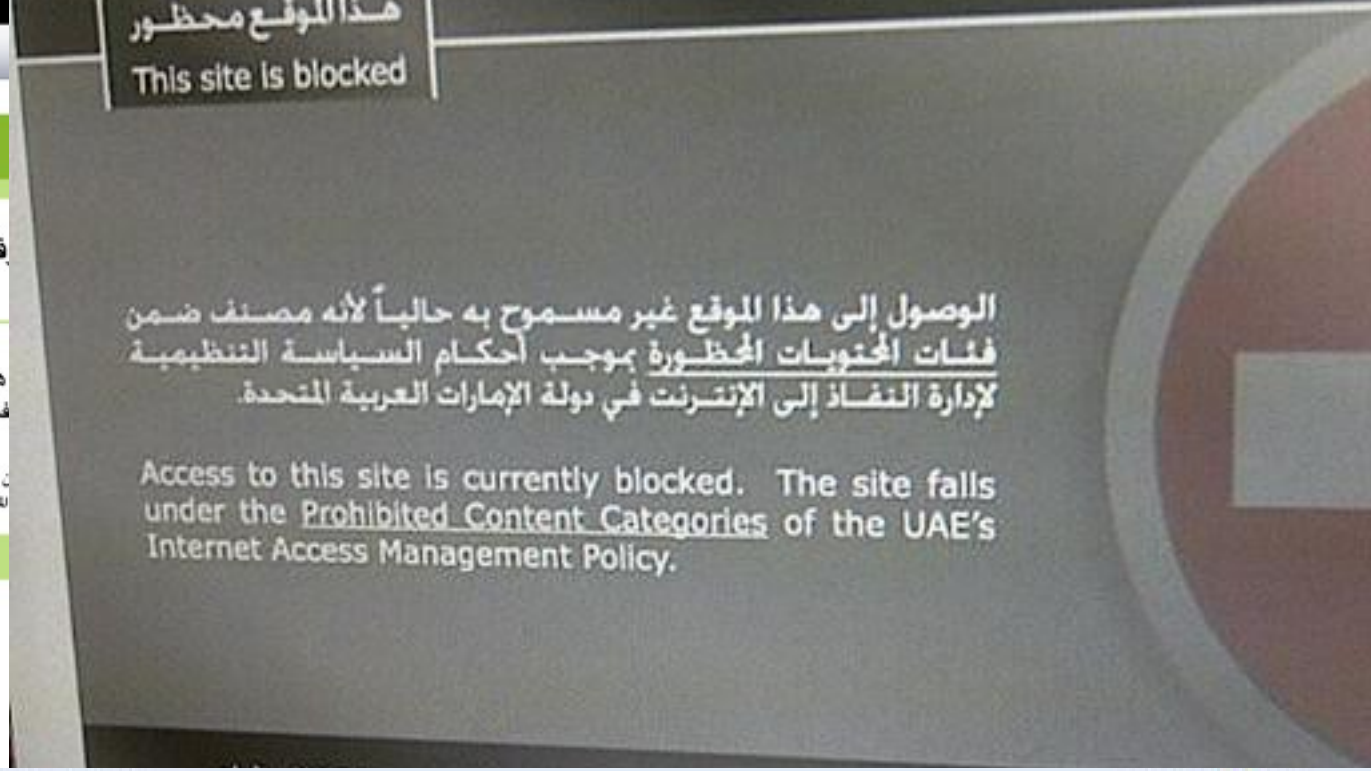

Chinese Tor users via bridges
30000
20000
10000
0
Jul
Aug
Sep
Oct
Nov 09


Bridge users from China
50000
40000
30000
20000
10000
0
2010
2011
2012
The Tor Project - https://metrics.torproject.org/

Your request was denied because of its conte

ء على اللوائح والقوانين
مع unblock.kw@kw.zain


10:00 AM
Blocked URL
ar User,
Sorry, the requested page is unavailable.
you believe the requested page should not be blocked please click here.
r more information about internet service in Saudi Arabia, please click here: www.internet.gov.sa
قع المطلوب غير متاح.
هذه الصفحة ينبغي أن لا تُحجب
فضل بالضغط هنا.
www.internet.gov.sa

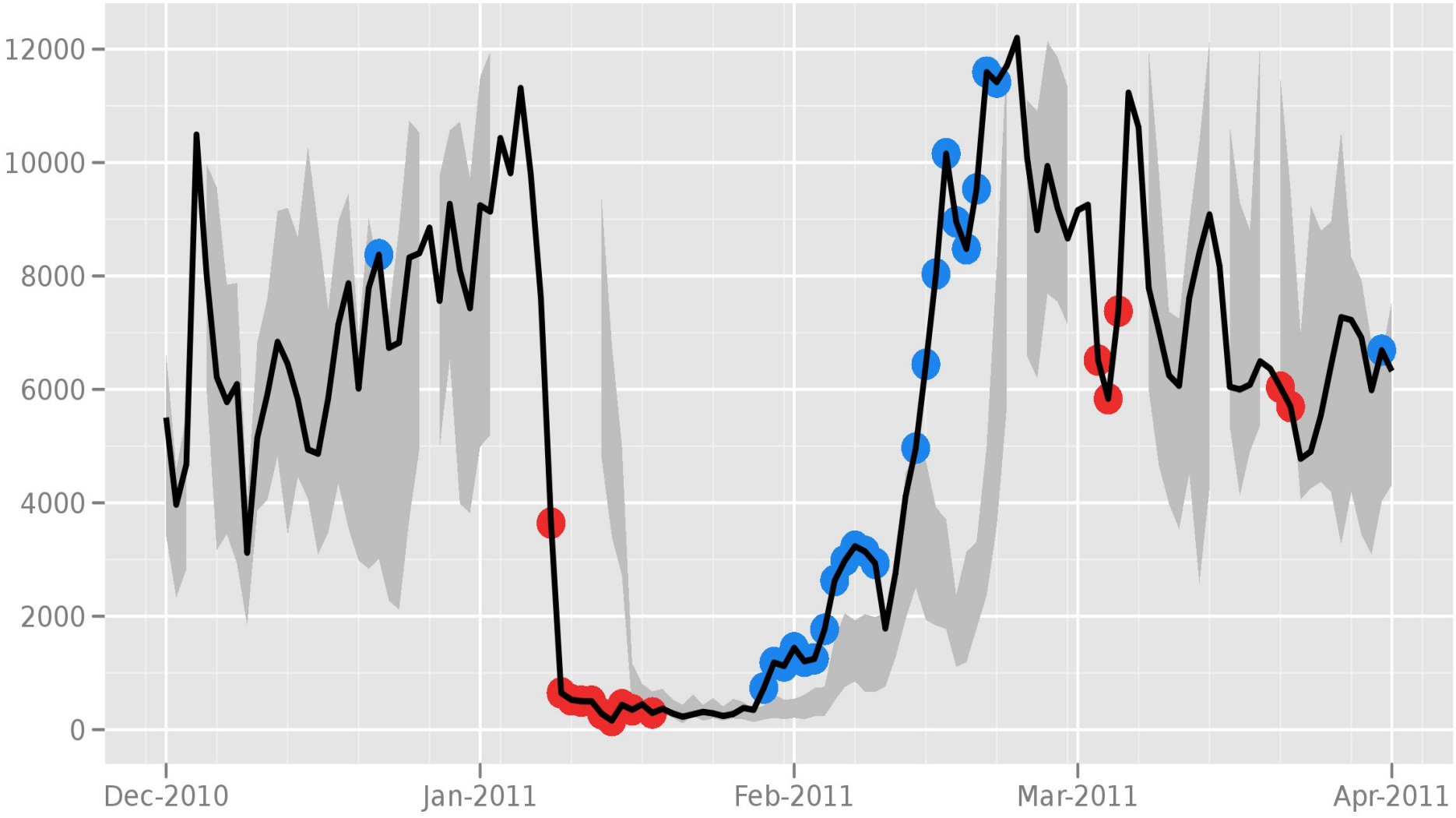

هـذا الموقـع محظـور
This site is blocked
الوصول إلى هذا الموقع غير مسموح به حالياً لأنه مصنف ضمن فئات المحتويات المحظورة بموجب أحكام السياسة التنظيمية لإدارة النفاذ إلى الإنترنت في دولة الإمارات العربية المتحدة.
Access to this site is currently blocked. The site falls under the Prohibited Content Categories of the UAE's Internet Access Management Policy.

KT WATA...
٩:٢١ ص
87%
Tweet
Blocked by Mada Com...

مـــدى للإتصـــالات
mada Mada Communications
ان الموقع الذي تحاول زيارته محجوب
Access to this website is prohibited
This site is blocked according to the goverment filtering policy.
If you feel this page has been blocked in errors, kindly fill out the form and we will investigate.
Thank You.
Required fields are denoted by (*)
Full Name *
الإسم
Email *
العنوان البريدي
Blocked URL *
www.
.com
اسم المخالف
Comments
استفسارك
Submit

أفا oops
لقد تم منع الدخول إلى هذا الموقع
This site has been blocked
تم إيقاف عملية الدخول الى الموقع الذي تحاول زيارته نظراً لاحتوائه على محتويات محظورة
The web page you are trying to access has been blocked as the content contains prohibited materials
إذا كنت ترى أن هناك خطأ في ذلك - يرجى إرسال رسالة بريد إلكتروني إلى helpdesp.qa
If you feel this is an error then please send

Directly connecting users from the Islamic Republic of Iran



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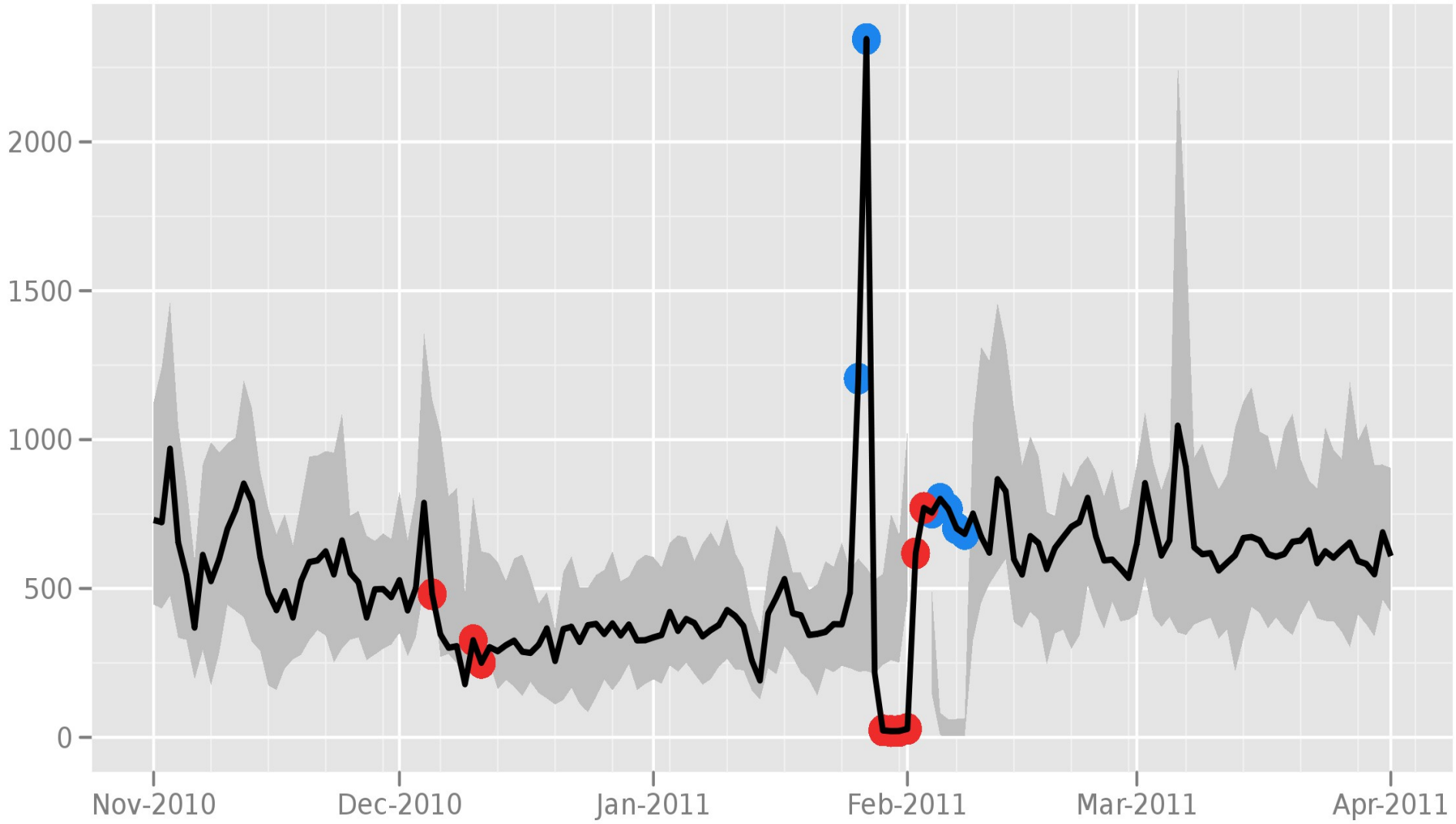
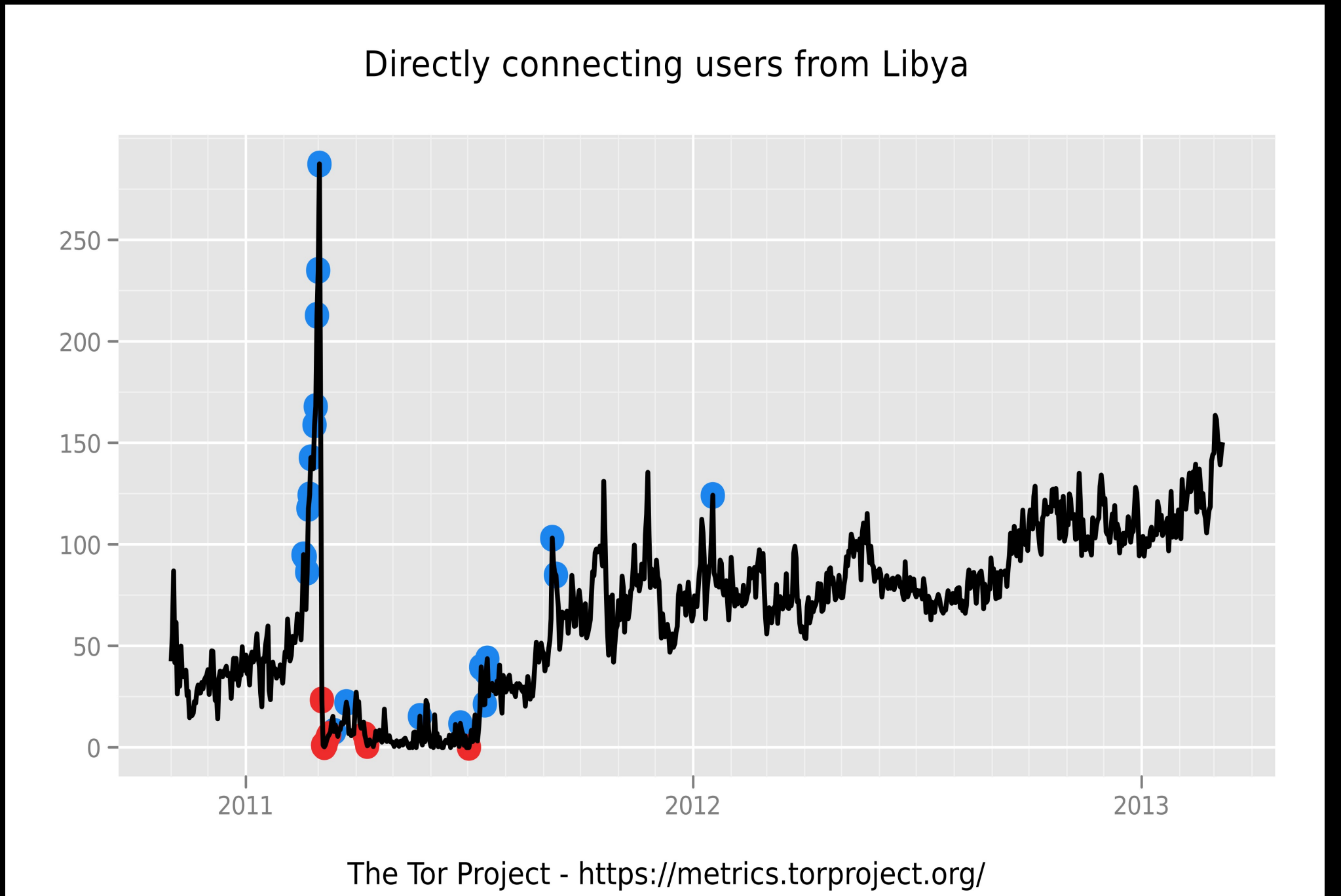
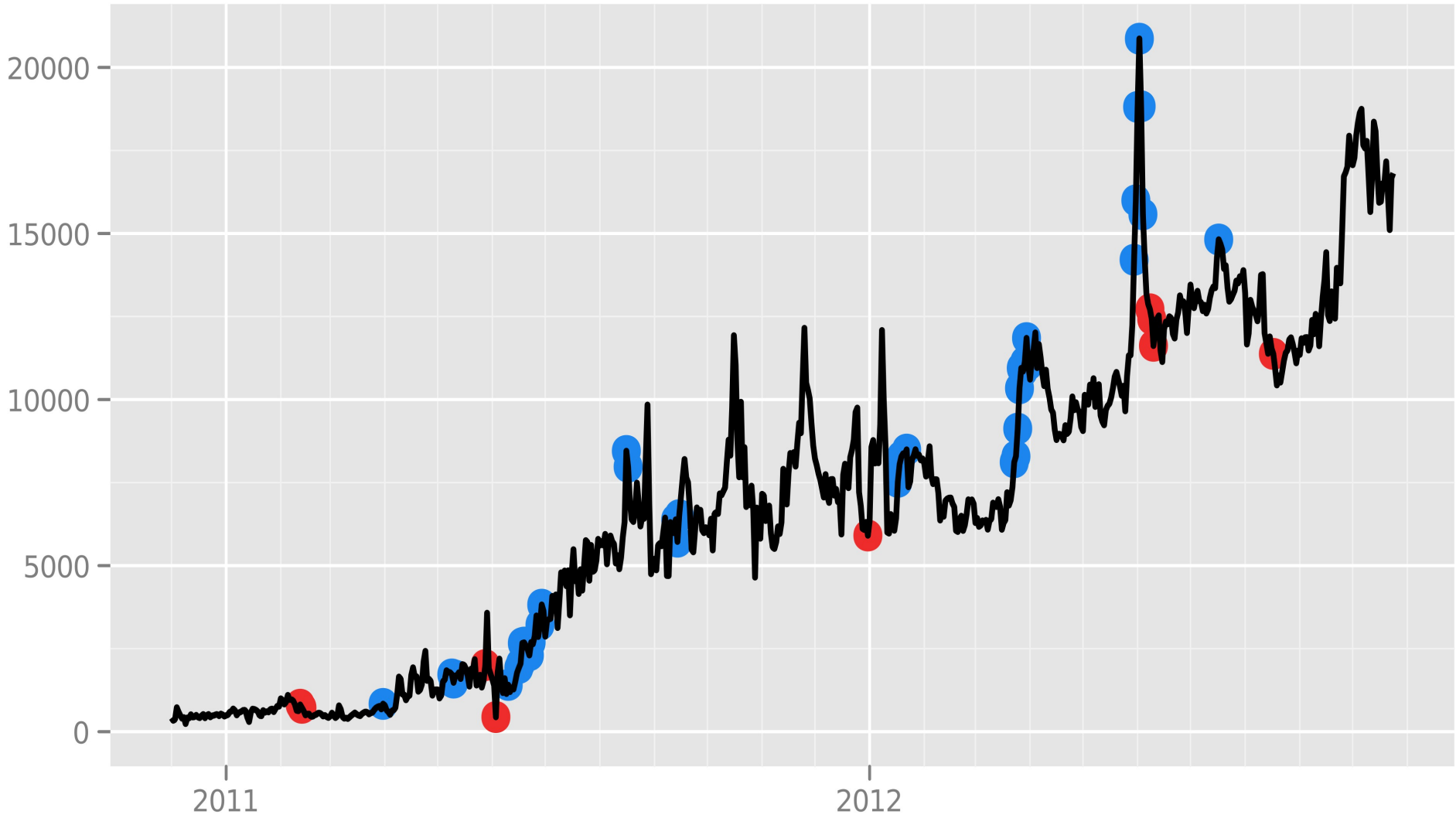
Directly connecting users from Egypt



The Tor Project - https://metrics.torproject.org/

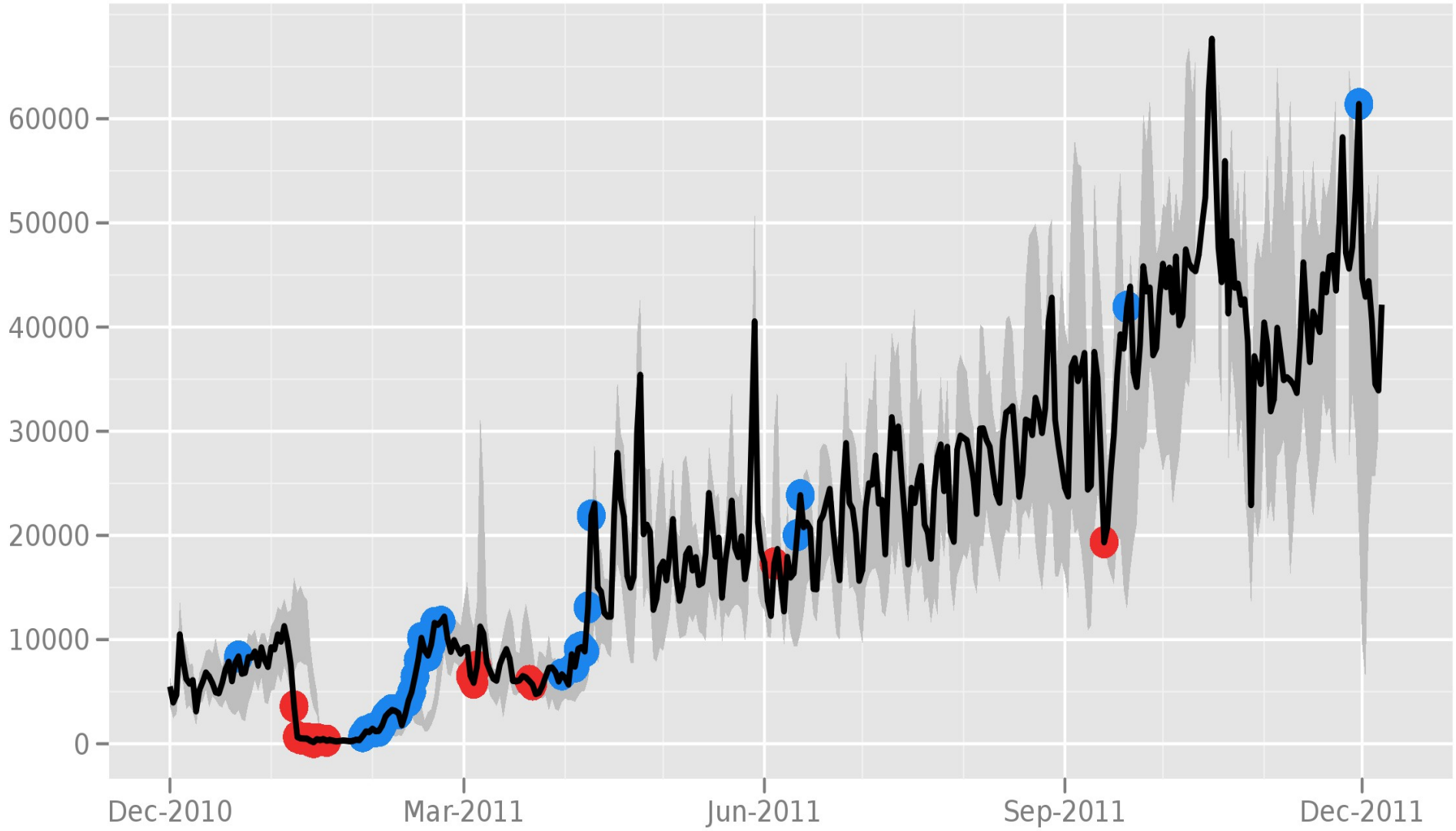

Directly connecting users from Libya
250
200
150
100
50
0
2011
2012
2013
The Tor Project - https://metrics.torproject.org/

Directly connecting users from the Syrian Arab Republic



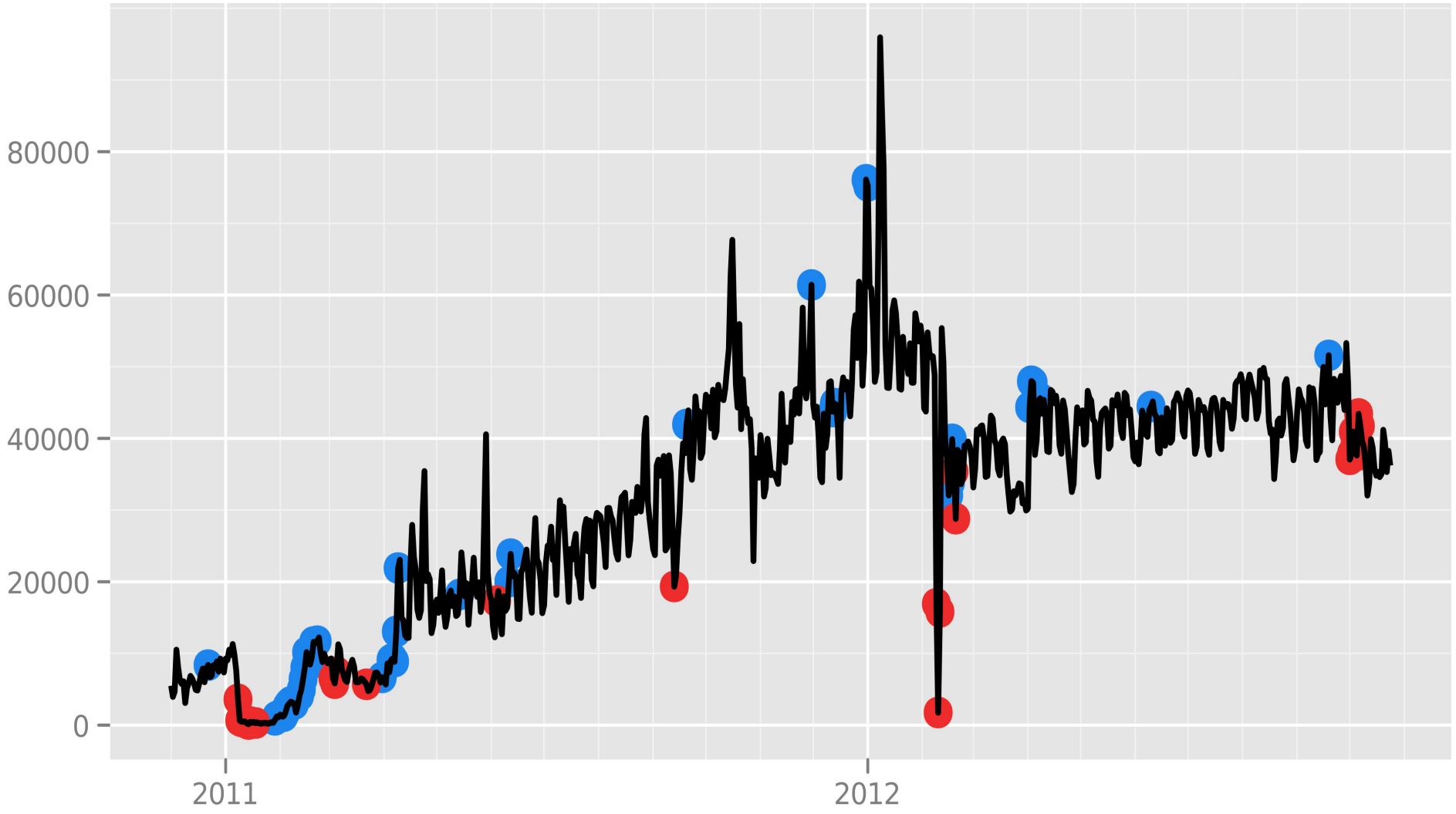
The Tor Project - https://metrics.torproject.org/

Directly connecting users from the Islamic Republic of Iran

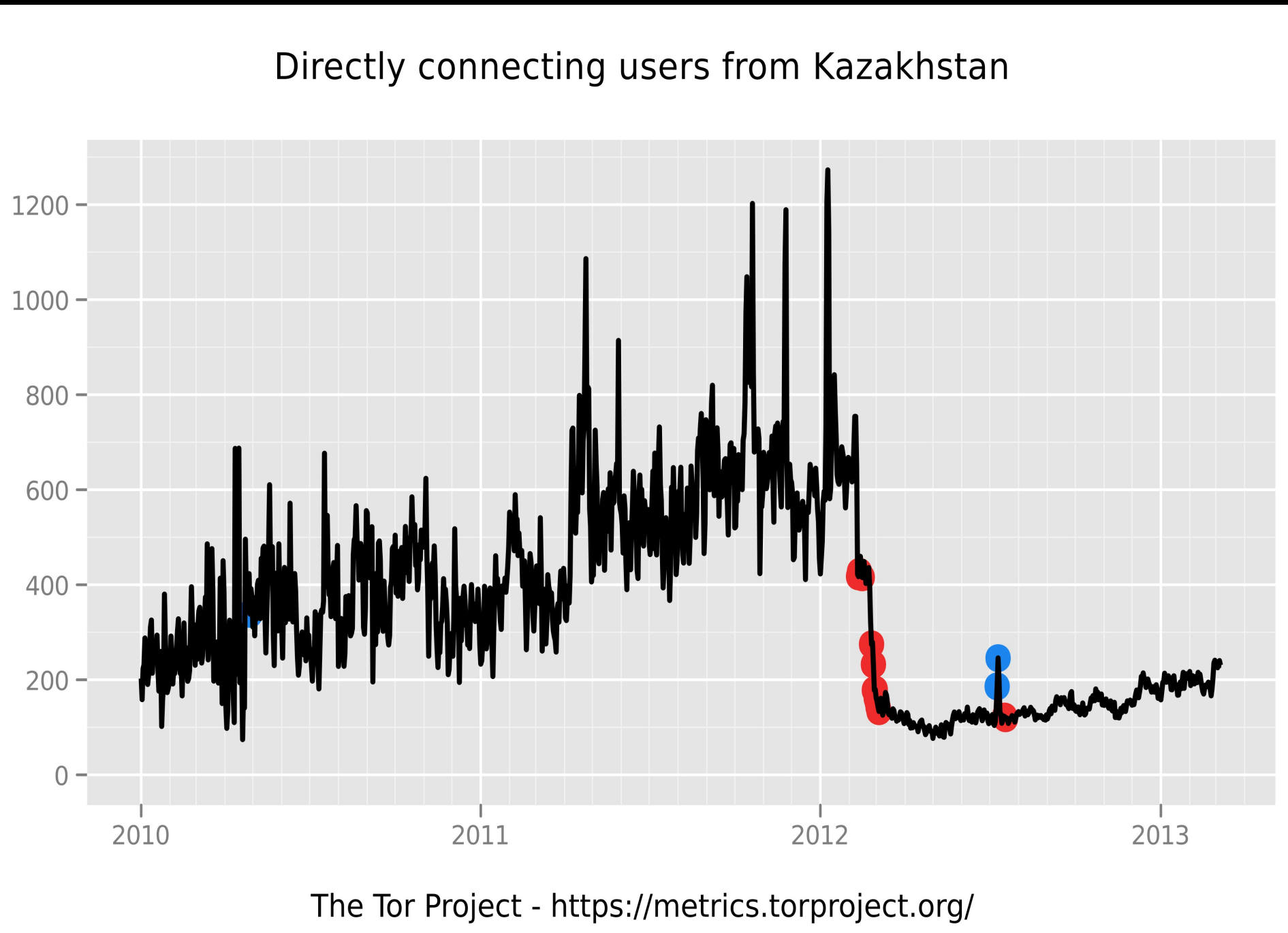


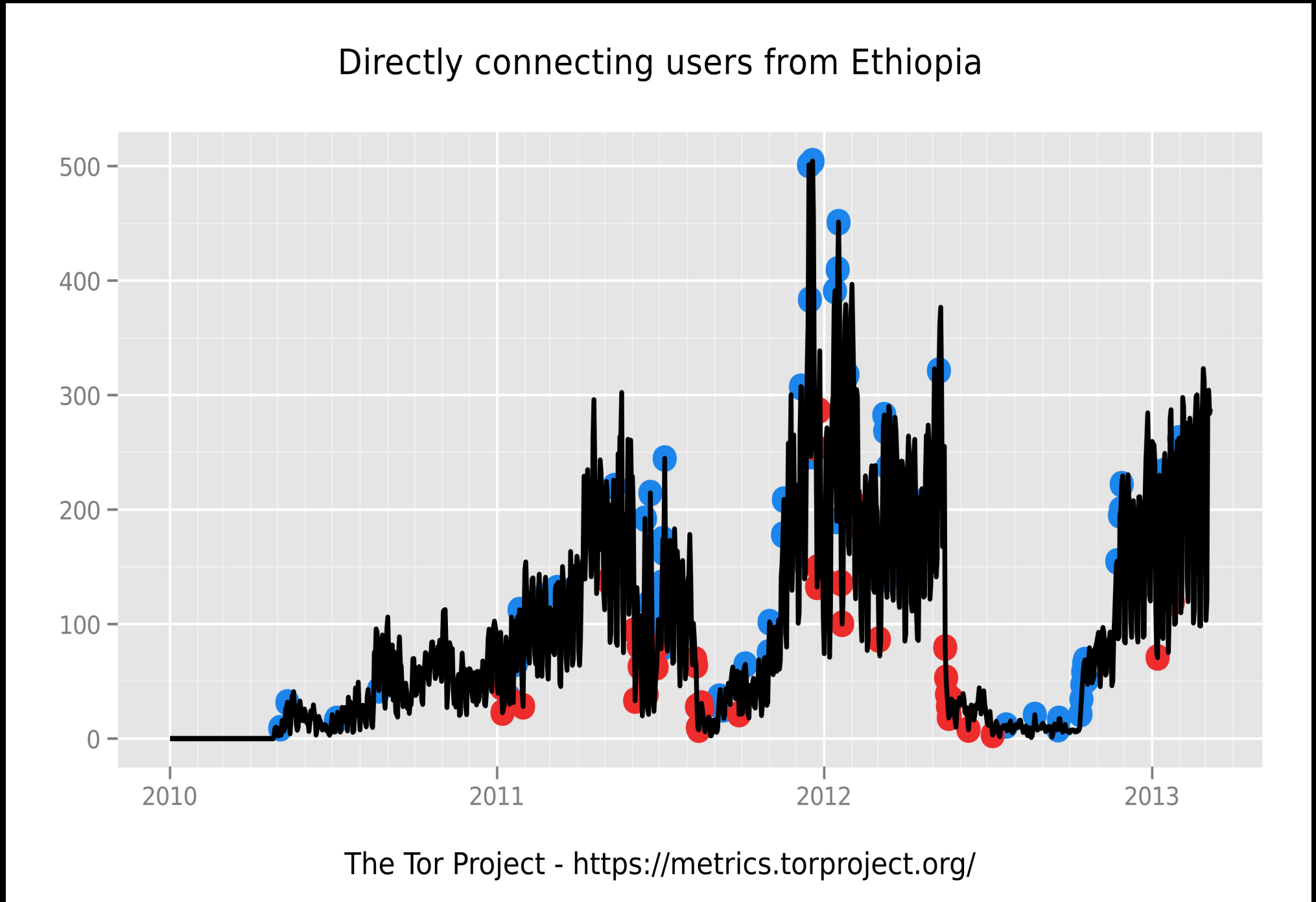
The Tor Project - https://metrics.torproject.org/

Directly connecting users from Iran



The Tor Project - https://metrics.torproject.org/


Directly connecting users from Kazakhstan
1200
1000
800
600
400
200
0
2010
2011
2012
2013
The Tor Project - https://metrics.torproject.org/

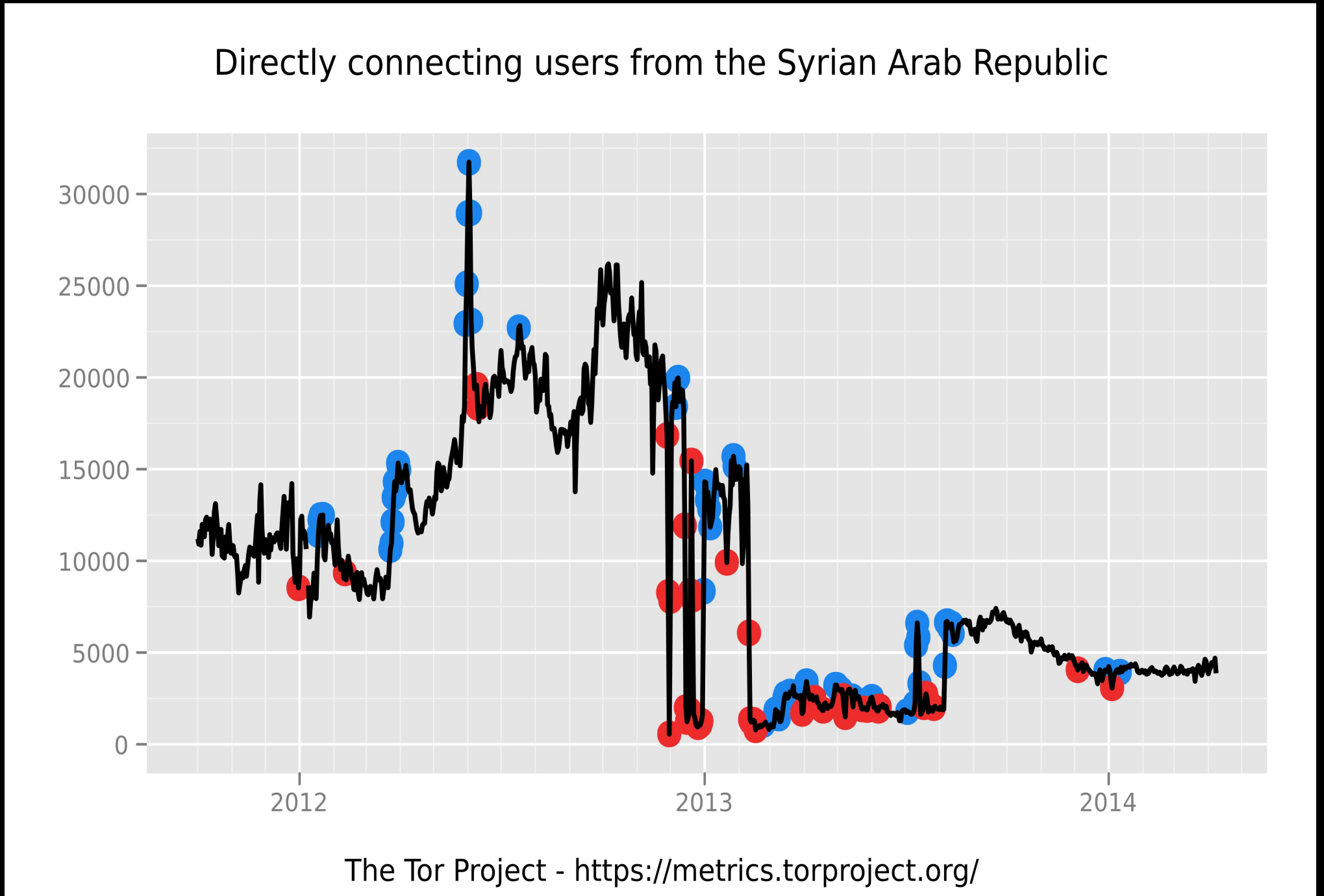

Directly connecting users from Ethiopia
500
400
300
200
100
0
2010
2011
2012
2013
The Tor Project - https://metrics.torproject.org/

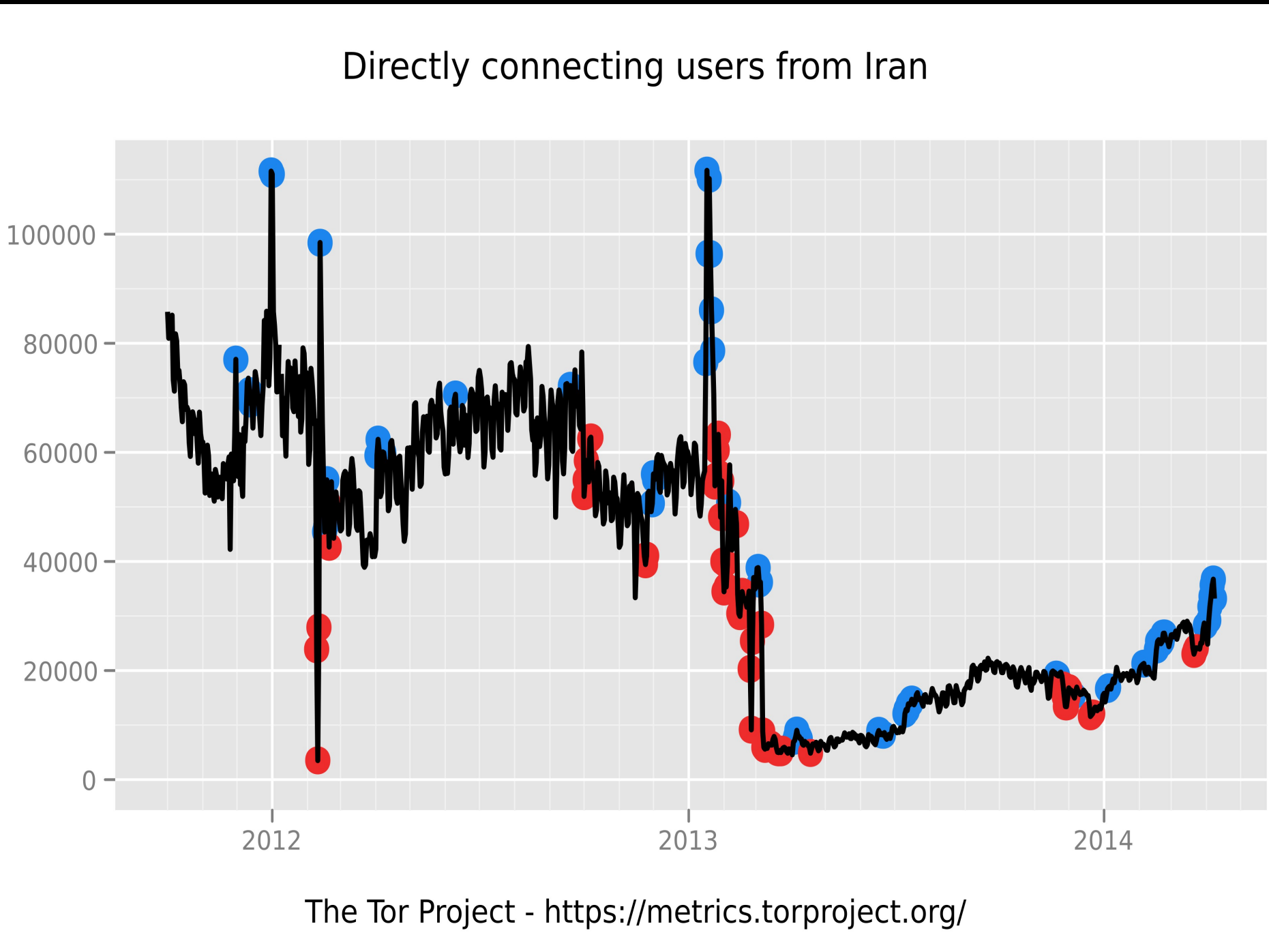
What we're up against

Govt firewalls used to be stateless. Now they're buying fancier hardware.

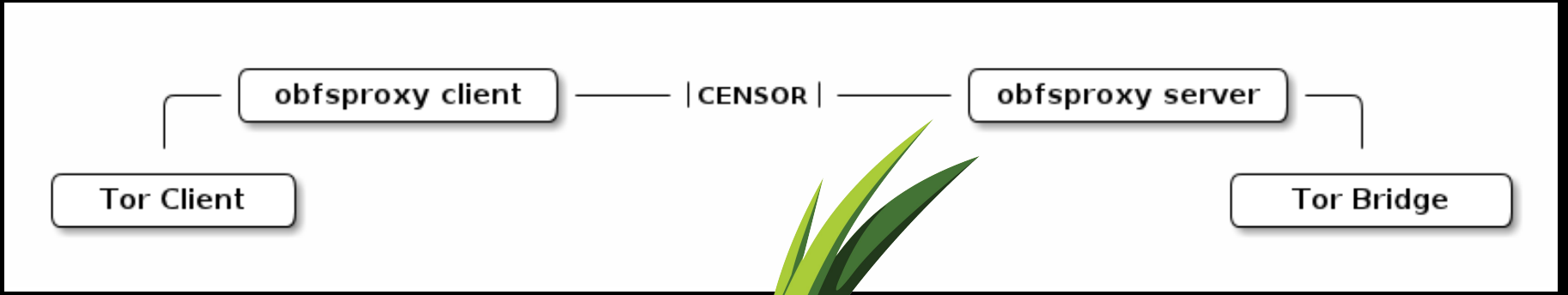
Burma vs Iran vs China

New filtering techniques spread by commercial (American) companies :(


Directly connecting users from the Syrian Arab Republic
30000
25000
20000
15000
10000
5000
0
2012
2013
2014
The Tor Project - https://metrics.torproject.org/


Directly connecting users from Iran
100000
80000
60000
40000
20000
0
2012
2013
2014
The Tor Project - https://metrics.torproject.org/

Modularity


obfsproxy client
|CENSOR|
obfsproxy server
Tor Client
Tor Bridge

Pluggable transports

- Flashproxy (Stanford), websocket
- FTEProxy (Portland St), http via regex
- Stegotorus (SRI/CMU), http
- Skypemorph (Waterloo), Skype video
- uProxy (Google), webrtc
- Lantern (BNS), social network based
- ScrambleSuit (Karlstad), obfs-based
- Telex (Michigan/Waterloo), traffic divert

Tor's safety comes from diversity

- #1: Diversity of relays. The more relays we have and the more diverse they are, the fewer attackers are in a position to do traffic confirmation. (Research problem: measuring diversity over time)
- #2: Diversity of users and reasons to use it. 50000 users in Iran means almost all of them are normal citizens.

Tor's anonymity comes from...

- The first 100,000 users (user diversity)
- The last 1,000,000 users (end-to-end correlation resistance)
- The first 1,000 relays (location diversity)

Only a piece of the puzzle

Assume the users aren't attacked by their hardware and software

No spyware installed, no cameras watching their screens, etc

Users can fetch a genuine copy of Tor?

I CAN HAZ
FREEDOM?
TorProject.org

Stinks (U)

[redacted]

CT SIGDEV

[redacted]

JUN 2012

Derived From: [redacted]
Dated: [redacted]
[redacted] On: [redacted]

“Still the King of high secure, low latency Internet Anonymity”

Contenders for the throne:

- None

NSA/GCHQ programs that affect Tor

- Quick Ant (QFD), Quantum Insert, Foxacid
- Quantum for cookie tests (good thing we moved away from Torbutton's “toggle”)
- Remember, they can do these things even more easily to non-Tor users
- At least they can't target specific Tor users (until they identify themselves)
- “Don't worry, we never attack Americans” (!)

Perception

- DoJ's aborted study finding 3% bad content on the Tor network
- How do you compare one Snowden leak to ten true reviews on Yelp?
- BBC's Silk Road articles telling people how to buy drugs safely

Trip report: Tor trainings for the Dutch and Belgian police

Posted February 5th, 2013 by arma in internet censorship, law enforcement, trip report

In January I did Tor talks for the Dutch regional police, the Dutch national police, and the Belgian national police. Jake and I also did a brief inspirational talk at Bits of Freedom, as well as the closing keynote for the Dutch National Cyber Security Centre's yearly conference.

You may recall that one of my side hobbies lately has been teaching law enforcement about Tor — see my previous entries about teaching the FBI about Tor in 2012 and visiting the Stuttgart detectives in 2008 back when we were discussing data retention in Germany. Before this blog started I also did several Tor talks for the US DoJ, and even one for the Norwegian Kripos.

Now is a good time to talk to the Dutch police, first because they're still smarting from the DigiNotar disaster in 2011, but second because of their 2012 ambitions to legalize breaking into foreign computers when they aren't sure what country they're in. (I say legalize because they already did it!)

Below are some discussion points that made an impression on me.

- I started the trip with a talk to about 80 people from the Dutch regional police. Apparently each regional police group has basically one cybercrime person, and pretty much all of them came to learn about Tor. These are the people who advise their police groups about how to handle Tor cases, so they're exactly the ones who need to know about services like ExoneraTor. (Afterwards, one of the national police thanked me heartily for teaching the regional police about Tor, since it makes *his* job easier.)
- One issue that came up repeatedly during the talks: what if a bad guy runs a Tor exit relay to provide plausible deniability when somebody shows up as his door? My first thought is that anybody who runs a Tor exit relay in order to attract *less* attention from

- Add a New
- Manage B
- Admin Co
- Manage U
- Add an Ev
- Manage E
- Manage F

Search

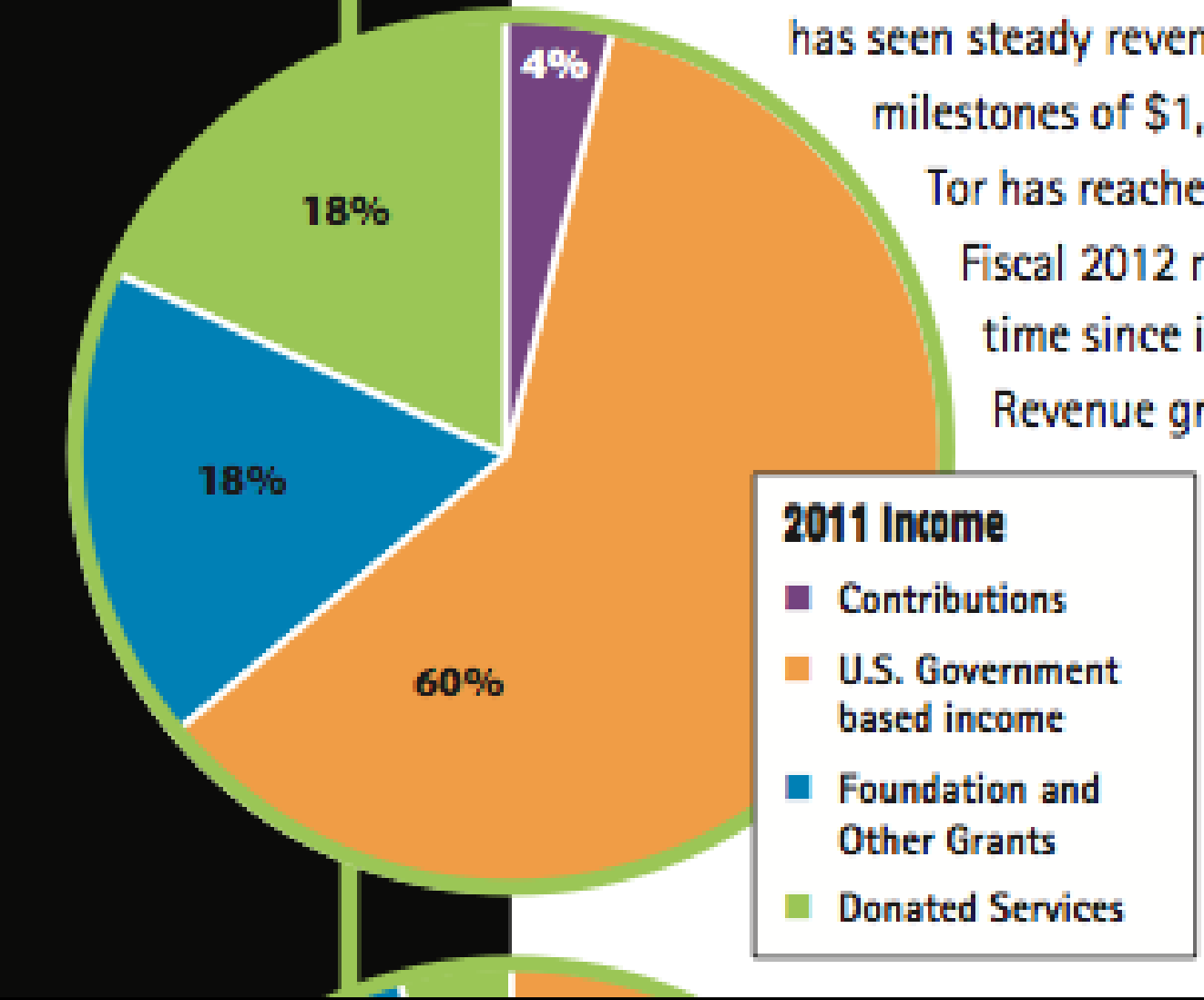
Upcoming

- Lunar @ Conferen
- Roger @ Worksho Enhanci Bloomin
- Tor at Pr Technolo
- Roger @

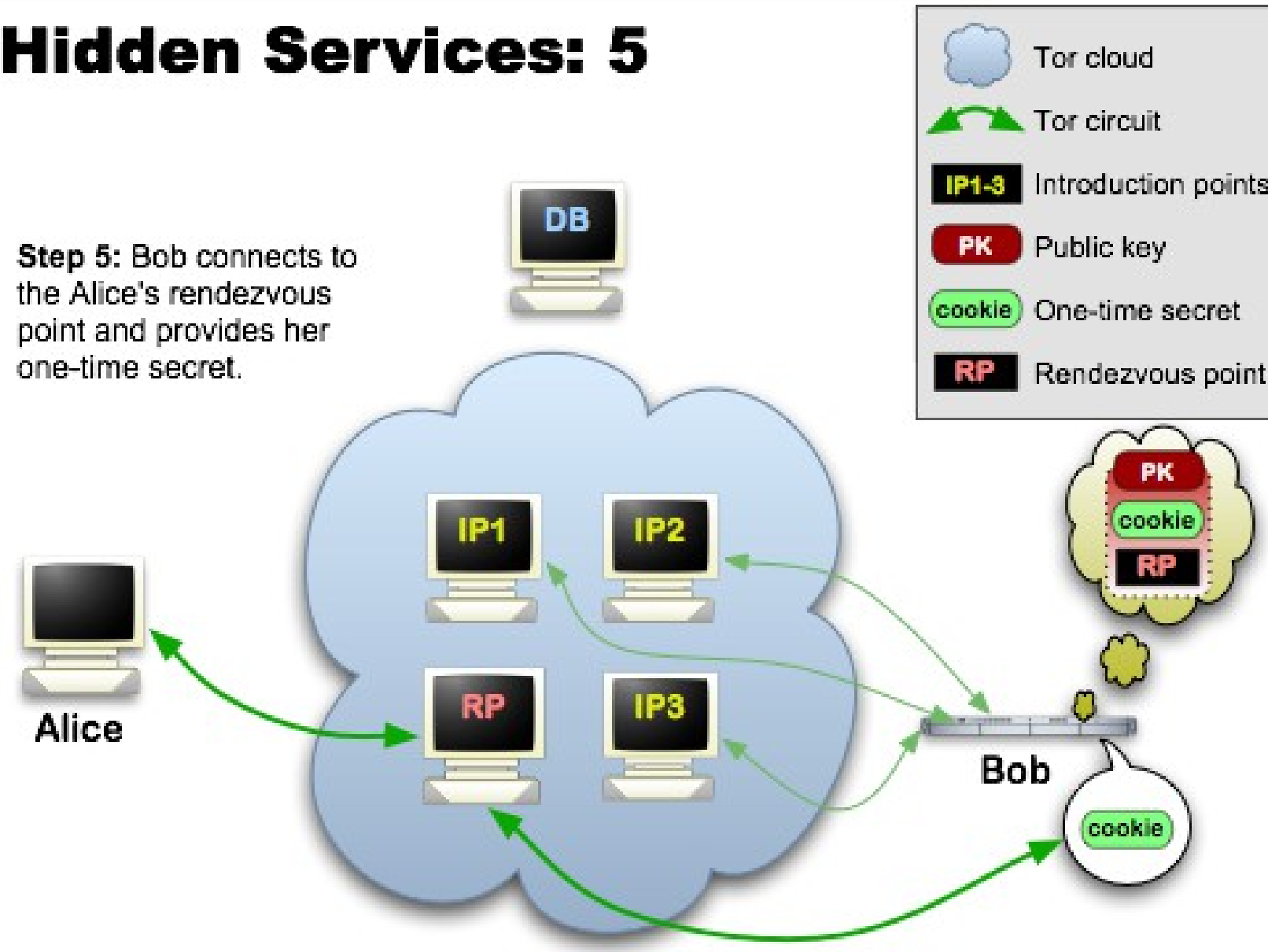
Financial Review

Tor's fiscal 2012 marked another year of financial improvemer
has seen steady revenue growth since its inception. Si
milestones of $1,253,241 in 2009, $1,574,119 in
Tor has reached new heights in 2012 with ove
Fiscal 2012 results also provided a new finan
time since inception: The Tor Project Inc. ha
Revenue growth was driven by diversity in
U.S. government federal fundi
International, Google, the Swe
Cooperative Agency, and priva

Fiscal responsibility is importa
to maintain financial stability,
sufficient to maintain operatio
Tor is proud to report that, sin



Hidden Services: 5



High-profile hidden services

The media has promoted a few hot topics:

- WikiLeaks (~2010)
- Farmer's market (pre-2013)
- Freedom Hosting (2013)
- Silk Road (2013)

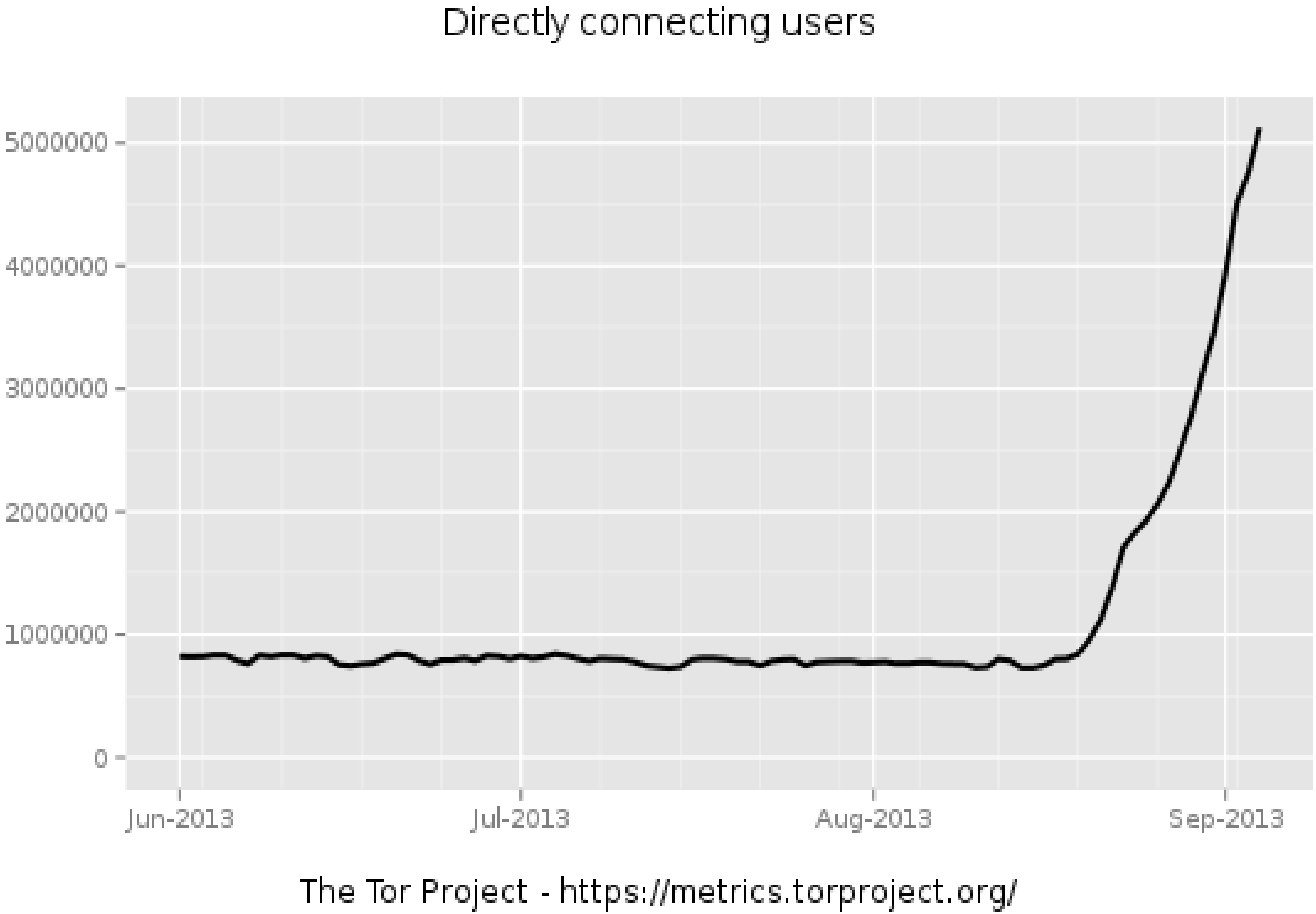
There are many more (eg: many GlobaLeaks deployments, etc) which aren't well known by the media (yet).

So what should Tor's role in the world be?

- Can't be solely technical (anymore, if it ever could have been)
- But technical is what we're best at (at least, historically)
- Remember how important diversity of users is

Three ways to destroy Tor

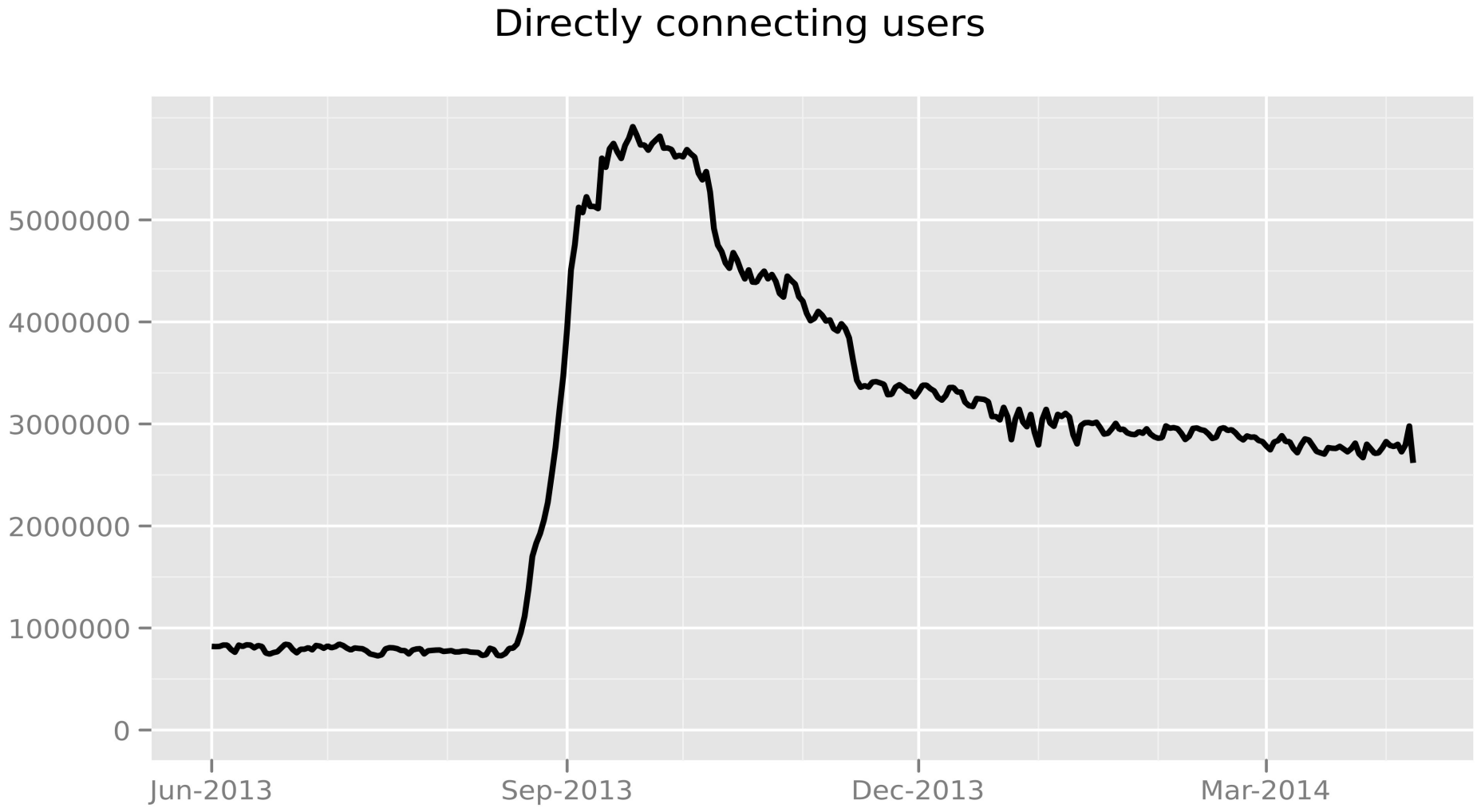
- 1) Legal / policy attacks
- 2) Make ISPs hate hosting exit relays
- 3) Make services hate Tor connections
  - Yelp, Wikipedia, Google, Skype, …


Directly connecting users
5000000
4000000
3000000
2000000
1000000
0
Jun-2013
Jul-2013
Aug-2013
Sep-2013
The Tor Project - https://metrics.torproject.org/

Botnet

- Some jerk in the Ukraine signed up 5 million bots as Tor clients (not relays)
- Our scalability work paid off!
- Good thing it wasn't malicious.
- Ultimately it didn't work: everybody noticed, and Microsoft has been cleaning up the bots

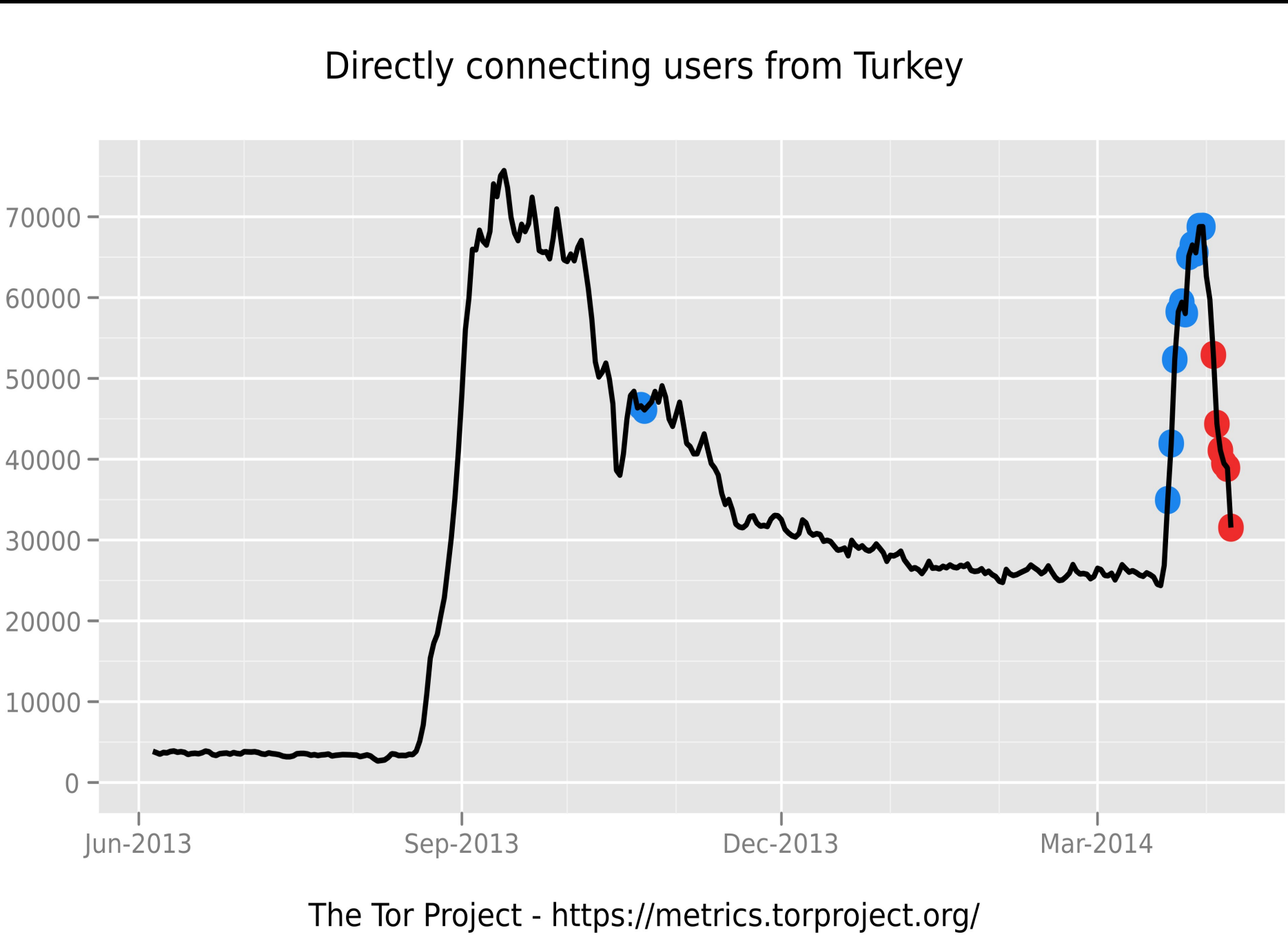
Number of daily Tor users



The Tor Project - https://metrics.torproject.org/

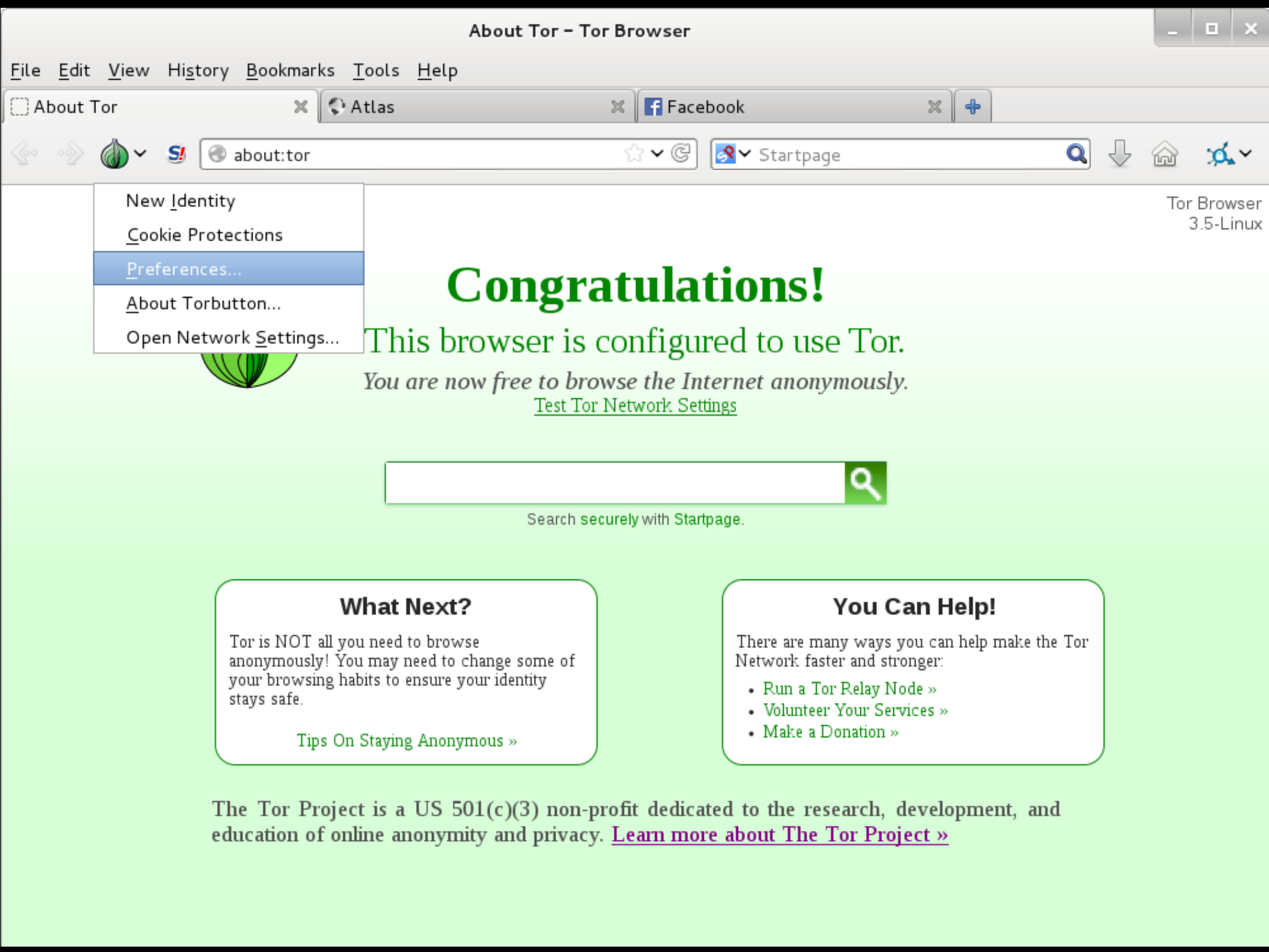
So what's next?

- “Tor: endorsed by Egyptian activists, Wikileaks, NSA, GCHQ, Chelsea Manning, Snowden, ...”
- Different communities like Tor for different reasons.

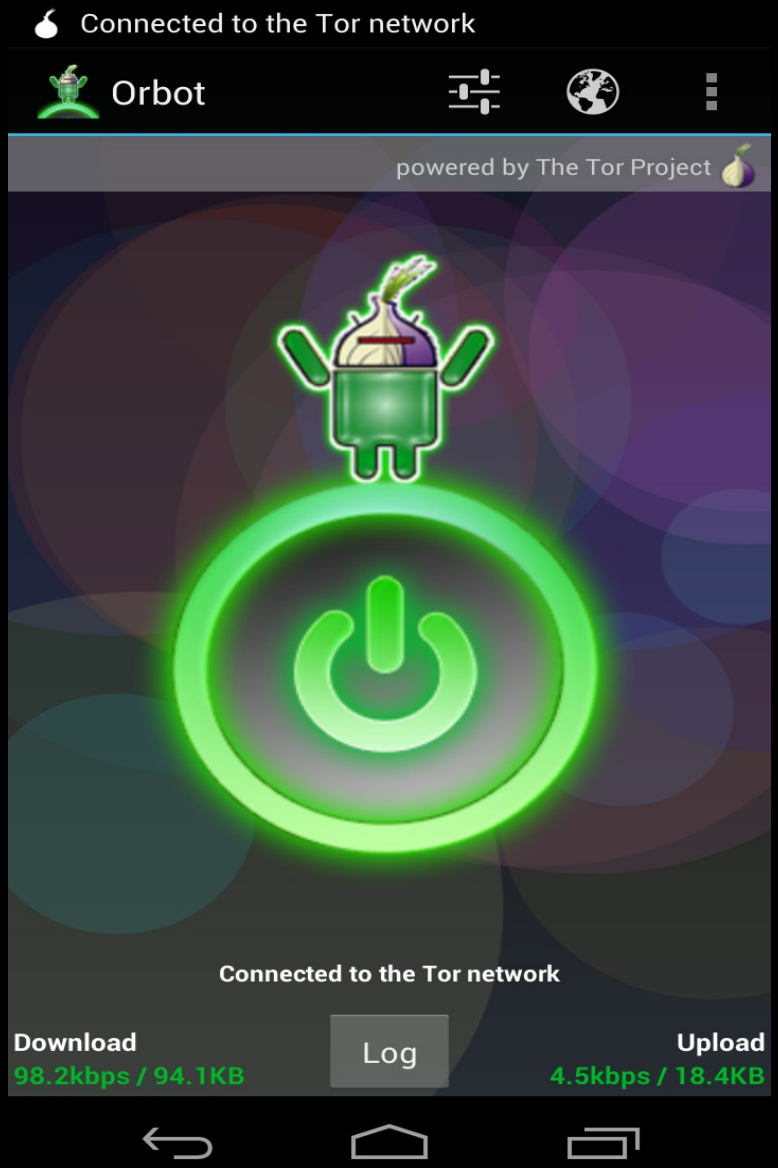

Directly connecting users from Turkey
70000
60000
50000
40000
30000
20000
10000
0
Jun-2013
Sep-2013
Dec-2013
Mar-2014
The Tor Project - https://metrics.torproject.org/

Tor Browser Bundle 3.x

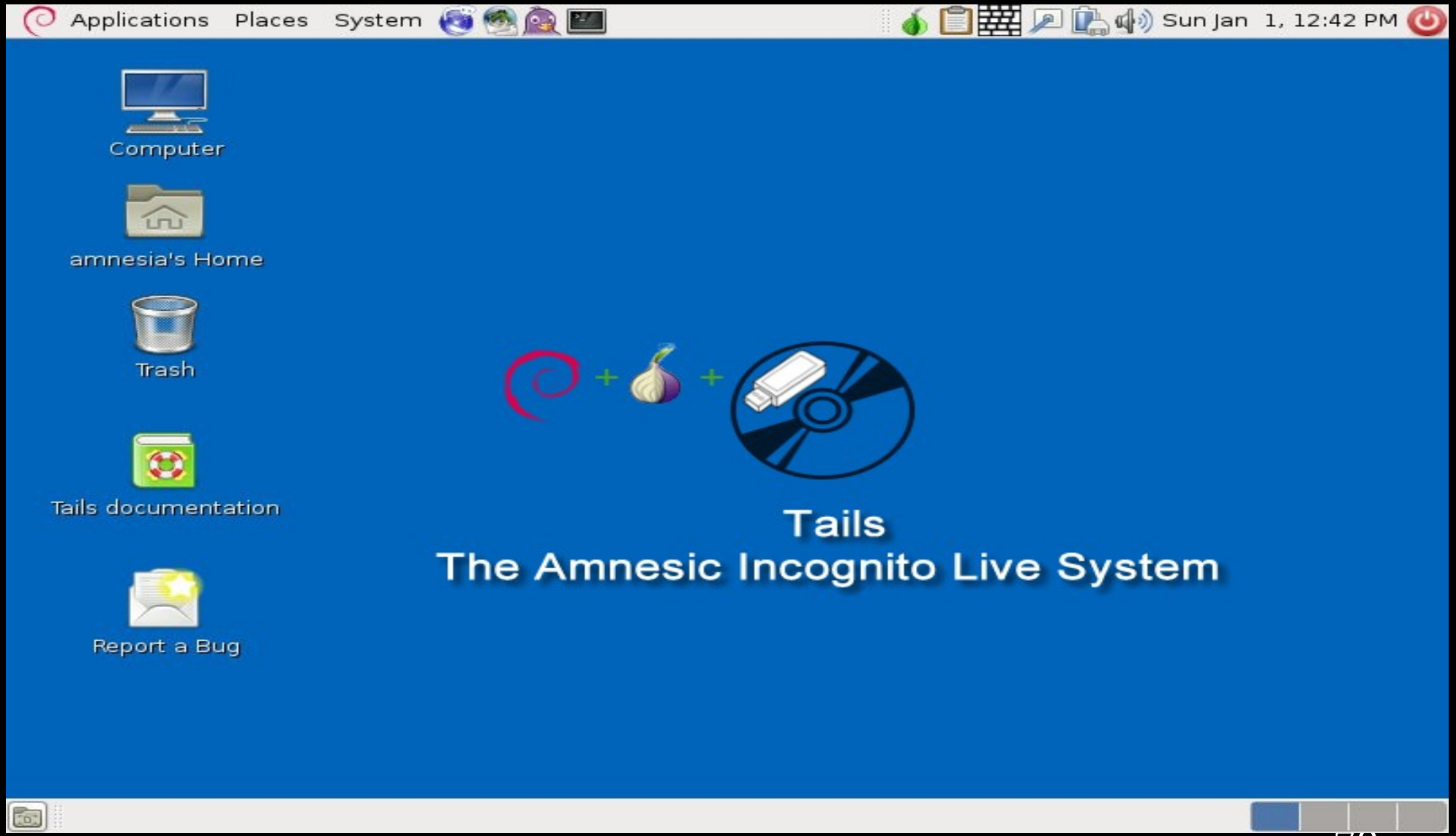
- Deterministic Builds
- “Tor launcher” extension, no Vidalia
- Asks if you want bridges first
- Local homepage, so much faster startup
- Security slider (for e.g. JavaScript)
- Privacy fixes, e.g. font enumeration


About Tor – Tor Browser
File Edit View History Bookmarks Tools Help
About Tor
Atlas
Facebook
about:tor
Startpage
New Identity
Cookie Protections
Preferences...
About Torbutton...
Open Network Settings...
Tor Browser
3.5-Linux
Congratulations!
This browser is configured to use Tor.
You are now free to browse the Internet anonymously.
Test Tor Network Settings
Search securely with Startpage.
What Next?
Tor is NOT all you need to browse anonymously! You may need to change some of your browsing habits to ensure your identity stays safe.
Tips On Staying Anonymous »
You Can Help!
There are many ways you can help make the Tor Network faster and stronger:
Run a Tor Relay Node »
Volunteer Your Services »
Make a Donation »
The Tor Project is a US 501(c)(3) non-profit dedicated to the research, development, and education of online anonymity and privacy. Learn more about The Tor Project »

Orbot


Connected to the Tor network
Orbot
powered by The Tor Project
Connected to the Tor network
Download
98.2kbps / 94.1KB
Log
Upload
4.5kbps / 18.4KB

Tails LiveCD



“Core” Tor tasks

- Core Tor (specs, design, hidden services)
- Tor Browser Bundle, deterministic builds
- Metrics and measurements
- Bridges and pluggable transports
- Helping the research community
- Outreach and education